REPORT RESUMES

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CONFERENCE ON SYSTEMS APPROACHES TO CURRICULUM AND INSTRUCTION IN THE OPEN-DOOR COLLEGE (UNIVERSITY OF CALIFORNIA, LOS ANGELES, JULY 18-20, 1966).

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THE SYSTEMS APPROACH TO INSTRUCTION INVOLVES A CAREFUL SPECIFICATION OF LEARNING OBJECTIVES IN BEHAVIORAL AND MEASURABLE FORM, FOLLOWED BY A SUCCESSION OF EVALUATION-REVISION CYCLES IN THE INSTRUCTIONAL PROCESS, UNTIL NEW STUDENTS EXPOSED TO THE PROCESS ACHIEVE THE DESIRED OBJECTIVES. SEVEN MAJOR PAPERS WERE PRESENTED AT THE CONFERENCE--(1) THE RELATIONSHIP OF INSTRUCTIONAL PROGRAMS TO THE JUNIOR COLLEGE'S COMMITMENT TO CHANGE, (2) OPPORTUNITIES AND PROBLEMS IN THE USE OF COMPUTERS IN INSTRUCTION, (3) METHODS OF PREPARING OBJECTIVES TO SPECIFY STUDENT ACTION OR THE PRODUCT OF SUCH ACTION, THE CONDITIONS UNDER WHICH THE PERFORMANCE WILL OCCUR, AND THE MINIMUM ACCEPTABLE STANDARD OF PERFORMANCE, (4) METHODS OF DEVELOPING AND VALIDATING INSTRUCTIONAL MATERIALS FOR USE IN INSTRUCTIONAL SYSTEMS, (5) A DESCRIPTION OF AN OPERATIONAL PROGRAM, THE AUDIOTUTORIAL SYSTEM OF TEACHING BOTANY AT PURDUE UNIVERSITY, (6) A DESCRIPTION OF THE APPLICATION OF THE SYSTEMS APPROACH AT OAKLAND COMMUNITY COLLEGE, AND (7) THE USE OF THE SYSTEMS APPROACH IN DEVELOPMENTAL PROGRAMS. EMPHASIS THROUGHOUT THE CONFERENCE WAS ON THE DEVELOPMENT OF LEARNING EXPERIENCES IN RELATION TO EDUCATIONAL PURPOSES AND OBJECTIVES, THE NEED FOR FEEDBACK, AND THE NECESSITY FOR CONSTANT EVALUATION, REVISION, AND IMPROVEMENT OF THE SYSTEM. (WO)

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SYSTEMS APPROACHES TO CURRICULUM AND INSTRUCTION IN THE OPEN-DOOR COLLEGE

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Systems Approaches to Curriculum and Instruction in the Open-Door College

A Report of a Conference Sponsored by
the University of California, Los Angeles,
the American Association of Junior Colleges, and
the Accrediting Commission for Junior Colleges
of the Western Association of Schools and Colleges

July 18-20, 1966

Edited by
B. Lamar Johnson

Occasional Report No. 9

Junior College Leadership Program
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PREFACE

It is becoming clear that the junior college will be called upon to assume sharply increasing responsibility as enrollments in higher education skyrocket during the years immediately ahead. Junior college enrollments now approach one and a quarter million and are expected to double, or even treble, within the next decade. This expansion will inevitably be accompanied by a demand for greater efficiency in all aspects of operations—an efficiency that will make it possible for junior colleges to offer high-quality instruction to unprecedented numbers of students at a cost commensurate with that which society is able and willing to pay. Taxpayers and private donors to higher education can be expected to insist upon getting the highest possible value for every dollar spent on colleges and universities.

Previous junior college conferences held at the University of California, Los Angeles, have been concerned with various aspects of educational efficiency. In 1961, for example, the conference theme was "Institutional Research in the Junior College," a topic which is clearly relevant to the improvement of operations. The 1964 national conference looked to the future as it considered "New Directions for Instruction in the Junior College." And in 1965, the conference took a forward look at "The Junior College Library."

The 1966 conference in this series was addressed to efficiency in curriculum and instruction. More specifically, it dealt with a particular approach to teaching and program planning—a *systems approach.*

Although systems are widely used in business, industry, and government, the application of systems to education has seldom been explored. At UCLA in July 1966, however, some 250 conferees spent three days considering the relevance of systems approaches to the curriculum and to teaching in the junior college. Particular recognition was given to the junior college as an open-door college—an institution with responsibility for a notably heterogeneous student enrollment. Papers and discussions at the conference dealt with systems theory and, particularly with systems practices.

The pages which follow include the major papers given at the conference. It is unfortunate that the discussions which took place at conference sessions—as well as at meals, in corridors, and in lobbies—cannot be reproduced; they were among the most valuable features of "those days in July."

An indication of the interest generated by the theme of the conference was the attendance—and this during a nationwide airline strike—of more than 250 educators from seventy-five different colleges in sixteen states. Also in attendance were representatives of foundations, industry, architecture, and government.

The National Conference on Systems Approaches to Curriculum and Instruction in the Open-Door College is the tenth summer conference to be sponsored by the University of California, Los Angeles, and the Accrediting Commission for Junior Colleges of the Western Association of Schools and Colleges. The American Association of Junior Colleges has joined in sponsoring the last four of these conferences.

The editor wishes to express his gratitude to those who presented papers at the conference. Special mention should be made of Arthur M. Cohen, who served as chairman of the Conference Planning Committee, and of Robert E. Corrigan, vice-president of Litton Instructional Materials, whose firm contributed to the costs of the conference and to the publication of this report. The editor also thanks William Harper, director of public relations for the American Association of Junior Colleges for editorial services.

B. LAMAR JOHNSON

SECTION I

Goals and Objectives

JOHN LOMBARDI

THE OPEN-DOOR COLLEGE: A COMMITMENT TO CHANGE

THE OPEN DOOR AND UNIVERSAL HIGHER EDUCATION

The open door today has a different connotation than it had a generation ago. The open door for the junior college implies acceptance of the concept of universal higher education—a concept that was not current a generation ago among state universities which then maintained open-door admissions. Even among those few state universities which still maintain such admissions universal higher education is not considered part of the policy. In the junior college, this concept has become a principle, the distinguishing characteristic that makes the junior college the open-door college.

Such a concept could not be realized until universal public school education became a fact. It was not for lack of will or desire that universal higher education had not been adopted earlier, for, to Americans, "no community could be complete without its college or universitv." President Barnard of Columbia wondered "how England, with a population of twenty-three million, managed with four degree-granting institutions, while the state of Ohio, with a population of only three million, supported thirty-seven."[1]

Very early, Americans were convinced "that society could not afford to waste any of its intellectual or psychic talents," that "talent was to be found everywhere, and everywhere, too, in equal abundance—among the poor as among the rich, among Negroes as among whites, among the perishing and dangerous classes as among the respectable."[2]

Universal education through the fourteenth grade was first announced officially as a national ideal by President Truman's Commission on Education in 1948 and reaffirmed ten years later by President Eisenhower's Committee on Education beyond the High School. Since then, recommendations for two years of education beyond the high school have been made with increasing regularity by government and educational leaders and groups. President Johnson in a commencement address in June asked, "Shouldn't we keep pace with the knowledge explosion and aim perhaps to give every child an extra two years of school?"[3] In a similar vein, U.N. Ambassador Arthur N. Goldberg advocated "that public education ought to be expanded broadly at all levels," but, "in particular . . . that fourteen years of compulsory education for *all* would be desirable." This year, two government-sponsored groups, the National Commission of Technology, Automation, and Economic Progress and the White House Conference on Civil Rights, made recommendations for universal opportunity beyond the high school. In 1964, the Educational Policies Commission of the National Education Association advocated tuition-free education in its *Universal Opportunity for Education beyond the High School,* and in the same year the Democratic Party Platform included a plank that stated, "Regardless of family financial status . . . education should be open to every boy or girl in America up to the highest level which he or she is able to master."[4] Recently a group of educators under the sponsorship of the California Junior College Association, Southwest Region, prepared a proposal for a Community College Act as a basis for federal legislation. The purpose of the act would be to authorize federal support to states so that two years of free education beyond high school would be available to all. Dr. Thomas Merson, Director of Research, California Junior College Association, calls the proposal "the third Morrill Act."

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[1] Daniel J. Boorstin, *The Americans* (New York: Random House, 1965), p. 155.

[2] Henry Steele Commager, "Social, Political, Economic, and Personal Consequences," in Earl J. McGrath (ed.), *Universal Higher Education* (New York: McGraw-Hill, 1966), p. 10, paraphrasing Lester Ward, sociologist and educator.

[3] *AAJC Federal Affairs Bulletin* (Washington, D.C.: American Association of Junior Colleges), June 24, 1966.

It is worth noting that only Ambassador Goldberg suggested compulsory education. Nearly all aducators and commissions which have looked into the matter recommend that the opportunity be available, placing the responsibility for seeking education on the individual. On the community is placed only the responsibility to provide the education. For the next decade or more, this appears to be as far as society will go. Unless the push-button revolution comes faster than it has so far, society will continue to provide jobs for the great majority of adults. When adults are no longer needed for work, then compulsory education may be considered seriously.

SIGNIFICANCE OF THE OPEN-DOOR COLLEGE

This aspect of the open-door college makes the commitment to change imperative, for, in accepting universal higher education, the junior college has committed itself to providing an education for all high school graduates. This means broadening the curriculum to match the broadened base of scholastic aptitude among students. Instead of four or five objectives, the students bring hundreds. Instead of a minority of poor students, there is now a majority. Instead of a relatively homogeneous group from the dominant strata of society, there is now a heterogeneous group—a cross section of the population.

Added to this widening base is a widening of the role of the junior college to become "more than a feeder for the university." The junior college is being asked, according to Gleazer, to "respond to some of the special social and economic problems of urban centers, particularly unemployment and related social ills,"[5] just as the colleges and universities "contributed to the development of rural America."[6] The attention given to this expanded role of the junior college stems from the tremendous sense of national involvement in education, an involvement which impinges with special force upon the junior college because so many of its students come from the social and economic groups that are seeking a more favored position in American society. Today's concern with change in education is a continuation of a long tradition in American history in all fields. In his book *The Americans,* David Boorstin asked, "Who could have predicted that Puritans would become Yankees? That a people rooted in the old world for stiff-necked dogmatism would on this side become exemplars of ingenuity? That an old English sect notoriously single of purpose would become New England paragons of versatility? That Englishmen famous for keeping their eye on the path of heaven would develop an uncanny vision for new markets and a facility for shifting investments."[7]

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[4] Daniel Patrick Moynihan, "The Impact on Manpower Development and Employment of Youth," in McGrath, p. 66.

[5] American Association of Junior Colleges, Public Information Release, February 9, 1964. Edmund Gleazer is Executive Director of AAJC.

[6] *Toward Greatness in Higher Education: A First Report on the Ford Foundation Special Program in Education* (New York: Ford Foundation, 1964), p. 3.

The need for change is almost spelled out for the junior college in the statements of its proponents. President Harold B. Gores of the Educational Facilities Laboratories characterized the junior college as an academic WPA. A junior college should be, according to former Governor Terry Sanford of North Carolina, a strong advocate of education, an institution which undertakes everything not being taken care of elsewhere. Lest there be any doubt about what he meant, Governor Sanford listed activities such as educating illiterates, uplifting the underprivileged, retraining the unemployed. State Senator Walter Stiern of California urged the junior college to undertake the task of preparing Americans for recreational and leisure activities. These statements sound strange, but they are so only in the sense that they are saying in common, everyday language what educators have been saying for years in more elegant terms. Pick any text on junior college education and you will find a statement similar to James Thornton's: "It [the junior college] studies its community continually to learn the educational needs of its constituency and provides any course of two years or less that will accomplish socially desirable results."[8]

Thornton's statement (and similar ones made by other authors) embodies in today's language what has been an American ideal for more than one hundred years. It is no more inclusive than Andres D. White's that a university be created "where any person could study any subject."[9] The difference is that the dream is today approaching reality through the open-door college.

CHANGE IN THE JUNIOR COLLEGE

With this responsibility to maintain the open-door college, how well has the junior college fulfilled its commitment to change? Most of those in the field believe that they have been so busy shaping the new institution, adapting it to the educational mores, finding a place for it in the educational hierarchy, developing a philosophy or rationale for its many functions, reconciling its emphasis on quality with its obligation to quantity, developing an organization, and establishing occupational curricula that they have not had time to report on changes. Moreover, change has been so common that they have not thought of it as anything special. It has been a fact of life, a necessity for survival.

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[7] Boorstin, p. 3.

[8] James W. Thornton, Jr., *The Community Junior College* (New York: John Wiley, 1960), p. 34. See also Thornton, p. 281; Leland L. Medsker, *The Junior College, Progress and Prospect* (New York: McGraw-Hill, 1960), p. 88 ("The two-year college is indeed performing many functions. Some colleges are truly all things to all people"); and Malcolm S. MacLean and Dan W. Dodson, "Educational Needs Emerging from the Changing Needs of Society," in Nelson B. Henry (ed.), *The Public Junior College,* The Fifty-fifth Yearbook of the National Society for the Study of Education (Chicago: University of Chicago Press, 1956), p. 40 ("They [junior colleges] will be a center and a resource to which our citizens will turn to meet their educational needs whatever they may be").

[9] Commager, p. 6.

For example, in the evolution of the junior college, change in countless avenues was a necessity. The change from a high school organization had to be made. It was not enough to copy higher education patterns, for organizational patterns are not easily changed; nor were existing patterns, no matter how satisfactory for the original organization, usually adaptable *in toto* to a new situation. Educators had to show imagination and ingenuity to make the transition from the high school pattern to the higher-education orientation of the new institution. This has been an accomplishment not fully appreciated by educators. Junior college districts are confronted with problems caused by the growth of groups of colleges—to create a central organization and to develop a *modus vivendi* between such an organization and the colleges and among the colleges. Here, too, patterns are available, but communities, traditions, and customs require modifications of these patterns if satisfactory organizations are to be developed. That many different patterns are emerging indicates that innovatoin rather than imitation is the major thrust of this development in the junior college.

Another example may be found in curriculum development. In a comparison of catalogs of 1946 with those of 1966, tremendous changes are apparent in many areas. Whole new curriculum fields, such as paramedical, electronic, electronic data processing, public services, to mention only a few, were not available in 1946. Similarly, unusual efforts are being expended to develop programs for the low-aptitude students—a task of tremendous importance in today's social, economic, and technological upheavals.

Two examples will illustrate the thesis that much change takes place with little fanfare. In the pre-World War I era, radio technology was a popular occupational field; a few years later it was radio-television; not much later electronics replaced radio-television; and today microelectronic is displacing electronic technology in junior college curricula. In offering nursing-education programs, a curriculum innovation of the first magnitude was instituted and successfully incorporated in many junior colleges throughout the country. In California alone about one-third of the enrollees in all nursing programs are in junior colleges—a remarkable record.[10]

CRITICISM OF JUNIOR COLLEGE EFFORTS

Despite these examples, some critics have not been impressed. They, too, have analyzed junior college catalogs; but instead of dynamism, vitality, they have found stagnation. Bluntly, Professor Reynolds states "That while the institutional purposes proclaimed by the community college in its catalog may coincide satisfactorily with the definition [of the open door] . . . in only a relatively small number of instances does the developed educational program reflect a full realization of what these stated purposes imply." He also observes the infrequent "reassessment of the validity of the existing

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[10] Celeste Mercer (comp.), *Associate Degree Nursing Education Programs in California, 1953–1965* (Sacramento: California State Department of Education, 1966), p. 65.

statements of purpose of the community college in the light of rapidly changing socioeconomic factors."[11] More gently, but no less pointedly, Lamar Johnson contrasts the "exciting" developments taking place in four-year institutions with the absence of innovation in the junior colleges. In fact, the choice of title for his monograph *Islands of Innovation* is indicative of his thesis that the junior colleges have lagged in this respect, that "the general picture revealed in the survey is one of significantly less experimentation than would be expected, or certainly hoped for, in an institution which is often referred to as 'the most dynamic unit of American education.' "[12] Other critics have made similar observations that the commitment to change is not acceptable to large segments of instructors and administrators when it means deviating radically from traditional higher-education concepts.

EVALUATION OF JUNIOR COLLEGE EFFORTS TO CHANGE

These criticisms require the utmost consideration. The critics cited are not only two of the top leaders of junior college education but ardent proponents of junior colleges. In the following remarks no attempt is made to underestimate the importance of the criticisms; rather, the purpose is to understand the causes or factors which elicit such judgments, hoping thereby to force us to reexamine our premises and claims, and to bring about necessary changes, enabling us to fulfill our commitment.

First, we must admit that dramatic changes have occurred with less frequency in the junior college than in the other segments of education. The junior college cannot match the thoroughgoing reforms instituted in the high school curriculum of the past ten years nor can it point to a ferment similar to that being experienced in the four-year institutions with their experimentations in small units, four-course systems, reorganization of the science curricula, and the like.

Moreover, except in the fields of occupational and remedial education, there has been a slavish dependence on the high school and the four-year college. The junior-college-transfer curriculum and, to a lesser extent, experiments in general education have followed those of the high school, especially in mathematics, sciences, and foreign languages, and those of the four-year colleges because of the desire to facilitate the transfer of students. In a word, it seems that the junior college in this area is an imitator rather than an innovator.

There is evidence that junior college educators have admitted that the criticisms have merit, and, more important, that they have been doing something about them. In an unpublished paper, "Islands of Innovation Revisited," Mrs. Hope Powell, a student of Lamar Johnson's, summarized the results of a "Resurvey [of] Junior Colleges" to see whether in the three years since the publication of *Islands of Innovation* "there had been a corresponding acceleration in innovation." She reported that "junior colleges are searching, experimenting, and evaluating, to find solutions to the educational problems of the students of varying abilities, personalities, and cultures who are in increasing numbers coming to the junior college to be served." Although Professor Reynolds might say that this conclusion could have been predicted, since the assignment was to report on innovative practices, nevertheless, the list of such practices reported in a small number of colleges is impressive. Also worthy of mention are the many examples of visits of faculty members and administrators to junior colleges where notable changes are taking place. Recently, some of us heard the reports of visits to four colleges, Oakland Community, Stephens, Delta, and St. Louis. Admittedly these illustrations of change and receptivity to change, though impressive, are not enough for an institution to remain dynamic. The same criticism can be applied to Mrs. Powell's inventory that Lamar Johnson applied to his original inventory: they do not reveal any significantly wide experimentation. The results of the visits remain to be translated into action.

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[11] James W. Reynolds, "Needed Changes in Purposes and Programs of Community Colleges," in McGrath, p. 109.

[12] B. Lamar Johnson, *Islands of Innovation*, Occasional Report Number 6 from UCLA Junior College Leadership Program (Los Angeles: School of Education, University of California, Los Angeles, March 1964), p. 13.

THE CHALLENGE TO THE OPEN-DOOR COLLEGE

What the open-door college needs to remain dynamic is what Toynbee calls *challenge*. For the open-door college, the challenge is to convert the dream of universal higher education into reality. If this is a reasonable assumption, the question must be asked, will the open-door college be able to meet the challenge by providing the kinds of educational programs suitable for the heterogeneous population now entering its open door? Will it be able to overcome the resistance of many instructors and administrators to the full implications of the open-door college?

Considerable doubt exists that the junior college as it is now constituted is able or willing to make the necessary changes to fulfill its commitment. Daniel Moynihan, in an analysis of the implications of universal higher education, raises questions concerning the ability of the junior college to become in fact the open-door college. He writes:

> At the point of reaching universal opportunity for higher education, we reach the point of harder decisions. Unless we are utterly to debase the standards of higher education . . . it becomes necessary to exclude a large number of persons from higher education on the grounds that they are not able to master it.
>
> That is not an easy thing to do . . . It is a harsh thing to turn a young man away from a university because he is too poor to pay . . . but I fear it may be no less harsh a thing to turn a young man away because he is too dumb. Society's injustice is succeeded by nature's.

Though Moynihan implies that the university cannot adopt the principle of universal higher education, neither is he convinced that the junior college will accept this responsibility. "It may be," he suggests, "that institutions [note the plural] will have to be developed that will permit everyone to attend a thirteenth and fourteenth year."[13]

Moynihan is not quibbling in his statement about educating all youth. The use of the word "dumb" is deliberate; it avoids the euphemisms—low aptitude, disadvantaged, minority, culturally deprived, and similar terms—that have been used by junior college educators. Just as elementary and high schools developed programs for all students, so now the junior college is being asked to do so. However, fearful that the change will not be made, proposals for a new kind of post-high school institution are being suggested. One such proposal, entitled "Educating the Last Quarter—A New Responsibility for the Legislature,"[14] was presented to the New York State Legislature in December 1964. Such, of course, are the many programs operated under the Manpower Development and Training Act. The most recent was that announced by Secretary of Labor W. Willard Wirtz for the establishment of centers for "young men from disadvantaged areas to enable them to become potential recruits for police and protective service work."[15]

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[13] Daniel Patrick Moynihan, "The Impact on Manpower Development and Employment of Youth," in McGrath, pp. 66–67.

Some, though not all, of these centers are being established in junior colleges. But why not all of them? Is it because the open-door college in many places is not committed to this kind of change?

Society will not wait for any institution reluctant to change. If the open-door college cannot become what Gleazer calls "a new kind of college—standing between the high school and the university—offering broad programs of experience of value in and of themselves, neither post-high school as such nor pre-college as such,"[16] in order to meet society's needs, then Moynihan's prediction that other institutions will have to be developed will be fulfilled. Frank Bowles, director of the Ford Foundation Education Program, wrote:

> In recent educational history there are clear warnings that when the problems of education are not solved within the system they are appealed to the public arena. When this happens the decision is ultimately in favor of the majority. In other words, "if the educators will not change education, the politician will."[17]

Here lies the greatest commitment to change for the open-door college: to translate the dream of universal higher education into reality. This task is formidable, but not impossible. Despite what has been said, *Islands of Innovation* and "Islands of Innovation Revisited" provide evidence that faculties and administrations committed to the open-door college can develop a wide range of innovative programs suitable to the wide range of aptitudes of the students. Many college faculties are maintaining the most rigorous kind of courses for the gifted and are creating courses to help low-aptitude and disadvantaged students. They are not turning away young men who are "too dumb." The Oakland (Michigan) Community College's break with traditional classroom instruction and its adoption of a systems-development program is an outstanding example of versatility. And as long as junior college educators continue to attend these conferences held under the auspices of the Junior College Leadership Program, the commitment to change will not disappear.

Yet, I must conclude that in this task we need the will to resist "the pressures toward conformity rather than distinctiveness [that] seem to operate in any society and in any educational system."[18] We must believe with historian Henry Steele Commager that "The extension of schooling to the age of twenty is consistent with the American tradition and with American faith in the sovereign effect of education in our kind of society."[19] that "If we are to extend universal education by two years, let us be sure that we make no little plans. Let us not permit the potentialities of this forward leap to go by default."[20]

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[14] In *The Legislature and Higher Education in New York State* (New York: Academy for Academic Development, 1964), pp. 33–35.

[15] *Los Angeles Times*, July 3, 1966.

[16] American Association of Junior Colleges, Public Information Release, February 9, 1964.

[17] *Educational Opportunity and Political Realities* (New York: Academy for Educational Development, Inc., 1965), p. 11. See also Thomas R. McConnell, "State Systems of Higher Education," in McGrath, pp. 27–28.

[18] McConnell, p. 26.

The challenge is here. We in the open-door college must be committed to the changes necessary to meet the challenge.

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[19] Commager, p. 16.

[20] *Ibid.*, p. 18.

HARRY F. SILBERMAN

COMPUTERS IN EDUCATION: OPPORTUNITIES AND PROBLEMS

Every day, some newspaper or magazine tells about the great benefits to be derived from the use of computers in education. Instant access to distant libraries, individualized instruction, and relief from the many clerical chores of school administration are among the advantages frequently listed. These are not unreasonable objectives, but the problems of realizing them are too often left unspecified. Everyone wants change these days. But a distinction should be made between change and improvement. We are not concerned with change per se—but rather with improvement.

DESIGNING MODERN INSTRUCTIONAL SYSTEMS

One question implicit in the frantic planning activities of the many new agencies that have recently decided to serve education is *"How to design a modern instructional system."* A popular approach to this question is to copy other "innovators." Thus, many who are planning new schools are hard at work collecting the latest information on educational television, computer-assisted instruction, microfilm, educational parks, electronic data processing, and team teaching. They visit all the current sites in California, New York, and Florida on brain-picking expeditions and return reassured that their own system plan has everything and more than those centers they visited.

Another approach in designing an improved instructional system is to look to science for suggestions about what to do. Learning theorists and educational researchers have never been so popular. There is hardly an institute, seminar, or educational conference that doesn't feature a keynote address by some prominent researcher. The speaker describes a theory that bears his name, citing several research articles that support the theory. Unfortunately, if the school designer reads these articles, he will find that the experimental methods compared had different objectives and were therefore not comparable, that they had little in common with his problem, and that the just-better-than-chance differences obtained are not sufficiently large to afford practical decisions anyway. The theory itself probably gives little or no specific guidance about what the system designer should do. If the theory is specific, it probably requires the new system to be already operational, so that suitable parameters can be obtained to make the theory predict what would already be known.

An alternative approach to designing an instructional system is to begin with an analysis of the changes desired in student behavior. Indeed, if the people who design instructional systems paid less attention to abstract theory and innovative fans than to what they are trying to accomplish, they would

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DESIGNING MODERN INSTRUCTIONAL SYSTEMS

One question implicit in the frantic planning activities of the many new agencies that have recently decided to serve education is *"How to design a modern instructional system."* A popular approach to this question is to copy other "innovators." Thus, many who are planning new schools are hard at work collecting the latest information on educational television, computer-assisted instruction, microfilm, educational parks, electronic data processing, and team teaching. They visit all the current sites in California, New York, and Florida on brain-picking expeditions and return reassured that their own system plan has everything and more than those centers they visited.

Another approach in designing an improved instructional system is to look to science for suggestions about what to do. Learning theorists and educational researchers have never been so popular. There is hardly an institute, seminar, or educational conference that doesn't feature a keynote address by some prominent researcher. The speaker describes a theory that bears his name, citing several research articles that support the theory. Unfortunately, if the school designer reads these articles, he will find that the experimental methods compared had different objectives and were therefore not comparable, that they had little in common with his problem, and that the just-better-than-chance differences obtained are not sufficiently large to afford practical decisions anyway. The theory itself probably gives little or no specific guidance about what the system designer should do. If the theory is specific, it probably requires the new system to be already operational, so that suitable parameters can be obtained to make the theory predict what would already be known.

An alternative approach to designing an instructional system is to begin with an analysis of the changes desired in student behavior. Indeed, if the people who design instructional systems paid less attention to abstract theory and innovative fads than to what they are trying to accomplish, they would probably make more rapid progress. This statement can be explained with a brief description of the research and development program of the Education and Training staff at the System Development Corporation (SDC).

In 1958, we started a project to explore programmed-instruction technology. It appeared that existing programs provided for individual differences in rate of learning but did not provide for differences in the level of component skills of students during the course of instruction. A computer-based teaching machine was developed to provide for such individual differences. Students doing well would skip instructional segments while those having difficulty on a particular concept would be branched to remedial segments necessary to successful preformance on the concept. Experience with this machine quickly revealed that its effect on learning depended mostly on the effectiveness of the instructional materials used by the machine. One study effort, in an attempt to design improved instructional materials, surveyed the research literature on learning and made a series of experimental comparisons. The most notable result of the formal hypothesis-testing activities was that no statistically significant differences among experimental treatments were obtained. Different sequencing procedures, cueing techniques, response modes, display formats, and reinforcement procedures had but limited effect. Variables suggested by different learning theories were manipulated but again with little practical impact on student learning. The formal hypothesis testing and the literature search were abondoned and popular, new, commercially produced, programmed instructional material was tried. Considerable publicity had been given this material as the latest in modern instructional technology. It also failed to produce its advertised objectives.

Finally a procedure was tried that did succeed. This consisted of a careful specification of learning objectives in behavioral and measurable form, followed by a succession of evaluation-revision cycles. Each defect in the instructional material was detected, the behavioral components involved were reanalyzed, and specific changes were made in the defective segment. Ideas for possible changes were obtained from interviews and individual tutorial sessions with students. Repeated evaluation-revision cycles were conducted until new students exposed to the materials consistently achieved the desired objectives. Thus the developing package of materials was continually improved in the direction of a given set of absolute objectives.

This technique is quite different from a one-time evaluative comparison of the first version of the new package with so-called "conventional" procedures ("conventional" is that used by the other school). The evaluation-revision cycle is more like the engineering process, where the development activity is followed through to the final stage of implementation, and is much more costly in time and effort than the one-shot comparative study. However, the engineering approach, which begins with system objectives and uses self-correction procedures, culminates in workable tools and procedures that are guaranteed to do certain specified things for the instructor, while the traditional comparative-assessment study seldom goes further than a research report having little impact on a classroom practice. The engineering approach implies a commitment to make a new product or procedure work, rather than merely making a single evaluation for the purpose of deciding whether or not to adopt it—almost all new developments fail on the first try.

PROBLEMS OF IMPLEMENTATION

Persistent use of the evaluation-revision cycle will eventually produce high-quality self-instructional materials that can be used to provide individualized instruction. But that doesn't completely solve the problem of designing an effective instructional system. Even if large quantities of self-instructional material of high quality were available, many difficult implementation problems remain. For example, if students progress through the instruction at their own rate, how will it be possible to keep track of them (since they are all moving at different rates)? How is it possible to detect those who are not performing correctly and diagnose the source of their trouble? One of the greatest deterrents to such individualized programs, which allow each student to move along his own path at his own rate, is the difficulty of managing the instruction—far easier to keep everyone in lockstep groups, albeit at the expense of optimal learning. Indeed, resistance to individualized instruction may not stem from conservatism as much as from the management problems associated with it. Even student-teacher ratios of 15:1 do not permit detailed monitoring of individual student performance. How is the teacher to decide who gets help, what materials to change, how much review is required, if he lacks the data on which to make such decisions? The usual decision is made by giving help to the most vocal student—who may need it least!

The next question is *"What kind of management system should be established to maintain individualized instruction?"* The task of using the evaluation-revision cycle for improving instructional materials and for monitoring student performance requires some means of collecting performance data from the student, some means of analyzing the data, and some method of displaying the result to the teacher. Manual procedures would only add to the teacher's already excessive clerical burden, so let us assume that a computer is available for the task. A host of subsidiary questions is immediately raised by the introduction of a computer into the instructional-management system. For example, one question is *"How would school personnel, untrained in the field of computing, communicate with the machine?"*

One reason why some school people abandon systems involving computers is that they do not have control over the operation. They can only direct the machine through an intermediary programmer. The programmer generally builds a system for his own convenience, and once it is built he is reluctant to make major changes in it. The user soon recognizes the rigidity of the system that was supposed to serve him and either relinquishes his responsibility to the programmer or bypasses the machine system with an informal manual system of his own.

Occasionally a school person will learn programming with the intention of designing a user-oriented system. He soon gets caught up in the excitement of the new skill he has acquired, his tolerance for complexity undergoes an imperceptible metamorphosis, his threshold for the amount of preparatory user training increases, and he soon comes to disregard the occasional naive user whose cause he had originally championed. His interests drift to problems which are more easily solved by the computer. This problem-avoidance behavior may be cured by a strict adherence to the same evaluation-revision cycle prescribed for the improvement of instructional material. That is, computer-naive experimental subjects are asked to try the new computer program. If they have difficulty with it, the program is revised until even the most machine-shy woman in the school has no difficulty.

PLANIT: INPUT AND OUTPUT

Recently at SDC we have developed a user-oriented language that allows a teacher to prepare a lesson on a computer for subsequent presentation to a student. This language, called PLANIT, interprets for the computer the lesson design that is typed by the teacher in her own natural English. For example, PLANIT will begin operating by typing a message to the teacher asking her to choose one of several kinds of lesson frames (Problem/Question/Multiple choice/Decision/Copy). The teacher types the first letter of her choice (Q) and PLANIT requests the text of the frame by asking her to specify the question. The teacher types a text (Who invented the electric light?), PLANIT asks for anticipated answers (Specify Answers), and the teacher types the expected answers:

A	Marconi
B	Edison
C	Bell

Then PLANIT asks the teacher what actions should be taken depending on the particular answer given by the student (Specify Actions). The teacher, by the use of special commands, indicates feedback messages and appropriate branching decisions for various answer possibilities:

Student Answer	*Command*	*Feedback Message*
A	R:	That was the wireless telegraph
B	F:	Fine work
C	R:	Bell was the telephone man
–	B:	5

Special command F informs PLANIT to type out the feedback message following the colon, if the student gives that answer, and go to the next frame. Special command R indicates that the student should repeat that question after receiving the message following the colon. Special command B, which is not associated with any of the possible answers, indicates that the program should branch the student to frame number 5 if he gives any answer other than those that had been anticipated. When the lesson is ready to be executed, the teacher types EX and the student receives the questions in the designated sequence. A special feature of this language is that it also allows the student to *ask* as well as answer questions in his natural (occasionally ungrammatical and misspelled) English.

The main advantage of a user-oriented language like PLANIT is that it enables the nonprogrammer author to communicate directly with the machine by merely sitting at a typewriter keyboard and inserting the instructional sequence. But even though program languages such as PLANIT restore the teacher's control over computerized instruction, there still remains the problem of how to facilitate communication between the student and the machine. Ideally, the machine would, first, interpret all audio and tactual responses of the student and, second, be capable of generating meaningful audio and visual stimuli. Thus, in teaching reading or a foreign language, the computer should have associated input equipment capable of evaluating student pronunciation. (Young children should not have to learn how to type in order to insert responses into the machine.) Current research and development on interface equipment to meet such requirements is quite active. On the output side, we have the development of three-dimensional displays (holograms) and work on storage tubes that will make feasible TV-type displays at remote distances from the computer. Synthesis of speech is still in the early stages of development, but rapid progress is being made here also. On the input side, with the exception of a few devices that will interpret certain limited characteristics of speech, the evaluation of spoken utterances is still not possible.

Rapid progress is being made with tactual input devices, and it will soon be practical for students to respond by touching a display face or by writing on the face of a visual display with a special pen. At SDC we have developed a display that allows the teacher to draw graphic problems on a rectangular surface with a pen and save them in computer memory for subsequent presentation to students. The student will see the problems displayed on the surface and will use the same pen to inscribe his solutions on the display surface. The computer will evaluate the solution and make subsequent displays contingent on the student's solution.

IBM has been taking orders for a random-access filmstrip and sound-tape output device that is connected to its new Model 1500 computer-assisted instruction system. The 1500 can be programmed to select from messages on these devices. Eventually, however, the external storage of picture and sound will give way to storage within the computer. This internal storage will greatly ease the editing of stimulus material, but internally stored course content will require increased memory capacities and faster computer times before it is practical for school purposes.

COMPUTER COSTS

Another question raised by the introduction of a computer into the instructional-management system is *"How can a school district afford the cost?"* Anyone seriously considering the installation of a computerized instruction system need only calculate the rental charges of the computer, the cost per student terminal, and the transmission-line charges (not to mention the back-up costs of personnel who tend the needs of the system for new materials and maintenance services) to be convinced that a sober reappraisal of the budget is in order prior to such an innovation. The cost problem, salesman arithmetic to the contrary notwithstanding, remains as the single most important deterrent to the implementation of computerized instructional-management systems in schools.

Several alternatives that promise to alleviate the cost problem are available. Present hardware developments indicate that great reductions in cost and increases in capacity will be achieved in a few years. Similarly, the new technique of computer time-sharing promises to reduce the cost per student. Prior to time-sharing, the machine spent most of its time waiting for a new response from the user. With time-sharing, each of the various programs associated with different user functions is shuttled in and out of storage, operated in a fraction of a second, and replaced by another. In this fashion, better computer utilization is achieved and costs of computer time are shared, yet each user appears to have direct and instant access to the entire machine for himself.

Another method of reducing the cost of an instructional-management system is to degrade the system to some less costly compromise configuration. For instance, instead of providing an elaborate input terminal for each student, a smaller number of terminals can be shared among students who are scheduled (by the computer) to use the terminal at different times of the day. Another approach is to use a simple button-box input with small feedback lights instead of the more elaborate "rich" terminal, with its TV tube, keyboard, random-access film and sound. An even cheaper configuration would reserve the "rich" terminal for use by the teacher in querying the record of student performance. The student responses may then be entered in printed booklets treated with a material that changes color when the student marks the page in the correct fashion. The marks provide the student with immediate knowledge of results, and the pages are sent to the district office, where they will be read by a test-scoring machine that will put the data onto magnetic tape. The tape will be read by the computer and the data will be analyzed and sent back to the school over phone lines to generate special displays (at the single "rich" terminal) telling the teachers which students are having difficulties, what kinds of problems they are having, and what materials may be helpful in overcoming the problems. This alternative would avoid the high cost of having a terminal for each student, but it would require optical scanning equipment to read the data from the students' booklets.

Although the problem of alleviating the cost of the physical configuration seems manageable, little hope is warranted of solving the back-up logistics problem. This problem lies waiting like a submerged iceberg. To maintain the physical system, develop new materials for it, evaluate and revise it, requires an invisible staff of well-trained specialists whose ongoing price far exceeds the already substantial initial outlay required merely to install the physical system. Too often, school boards ignore the ongoing back-up logistics cost, buy the tangible physical system, and later wonder why it is never used. Perhaps the back-up costs can only be absorbed by changing the school-support practices in this country. Increased federal participation may be required to support the back-up resources associated with computerized instructional-management systems. Even the back-up costs, however, may be alleviated somewhat by integrating the instructional-management function with other school functions that may also benefit from the system and be able to share its cost.

COMPUTERS, COUNSELING, AND ADMINISTRATION

This possibilitiy raises another question: *"How can an instructional-management system be integrated with other existing school functions, such as counseling and administration?"* A little thought about the total school system soon convinces one that it is more than desirable to integrate all the school functions—it is necessary. Unless major student difficulties are quickly brought to the counselor's attention, and unless the administrative planning and routine data-processing procedures reflect the individual-progress method of instruction, only chaos will be forthcoming. Fortunately, a computer-based system lends itself to combined functions. For example, the same author language used for specifying computerized instruction may be used to specify an automated counseling interview to be subsequently conducted on the same terminal that was used for instruction. Similarly, the language may be used to specify a conversational interaction between the machine and the school superintendent for assisting him in planning his budget. At SDC we have used the PLANIT language for instruction, counseling, and administrative-planning functions. If one is collecting data on student performance, it is also possible to collect educational and vocational aspirations and routine administrative information on those students. Both kinds of information can be stored in the same data base. The information-retrieval program can use that data to generate graphic displays for administrators and counselors as well as for teachers. Once the data are in the computer, it is relatively easy to generate lists and multiple copies of various reports whose manual preparation currently takes exorbitant amounts of time away from the staff's more professional duties—those involving interpersonal exchanges with students.

The price to be paid for an integrated system is agreement on various procedures, such as using common formats to insure that data collected from different sources will be compatible with the computer programs used to process them. Getting agreement among school men on standard procedures (not to mention acceptance of the system itself) is a major roadblock and introduces another question concerning the use of computers in education: *"How can one build acceptance of new, computerized school systems?"* The normal response to this question is to involve the user. School people should be active participants from the earliest planning stages in developing the system. Another solution is gradualism. Rather than trying to sell a full-blown instructional-management system to a school district, it is better to start with a single terminal that is tied into a time-sharing system. If staff members can have on-line access to the computer merely by sitting at a typewriter and if there are user-oriented languages to facilitate communication with the machine, then someone is going to get "hooked" on the potential of the new toy. A visit to most computer centers late at night, even on weekends, will convince the hardened skeptic of the infectious nature of the game. The only way to get many programmers to go home and eat is to turn off the machine. Once a few staff members get excited about the programs being used, they will want more. The system will grow to fill the capacity of the computer, regardless of how large it is. First, it will be used for routine data processing, payroll, attendance accounting, and report generation; later, for counseling functions, information retrieval, predictive work, and administrative planning. Finally, the system will incorporate instructional management and be used to assist in the development of instructional materials. If a tool is useful, it will eventually be accepted in education. General-purpose tools introduced in one school district will be carried to another district by people trained to use them. Others will carry the technology to the next district and so on. The installation of equipment confronts school people with a tangible problem and almost forces change by its very presence. Much of the concern about political obstacles to innovation may in fact merely reflect a healthy resistance to tools that either do not work or are more troublesome than they are useful.

STAFF TRAINING

One prerequisite to the acceptance of computers in education is an effective staff-training program. The instructional-management system should be able to generate synthetic data which can be read into the data base for staff-training purposes. Thus the staff can learn how to use displays, make queries, and react to problems before hooking up all the student terminals. Simulation exercises might begin with relatively easy problems and gradually build up to real-life situations with some actual students working at real terminals, the live system eventually replacing the simulated data. The advantage of such simulation training is that it can condense realistic problems into a short time period to test and improve the diagnostic, troubleshooting skills of the staff in a safe environment. Such exercises are very popular for training teachers, counselors, and administrators. The effectiveness of such training is best measured by whether or not the students of simulation-trained staff members learn more efficiently.

If the consequences of staff actions in the simulation accurately reflect (or model) what would really happen, and if staff members are taught a conceptual framework to tie their simulated experiences together, the training might be of some value. Here again, as with the improvement of instructional materials and of program systems, the simulation ought to be revised till the student-learning criterion is affected. It is easy to simulate, but not so easy to develop simulation-training programs that work when assessed by an external criterion. If the staff-training problem alone is solved, the acceptance question may solve itself; it may therefore have been unnecessary to consider it in this paper.

ARTHUR M. COHEN

DEFINING INSTRUCTIONAL OBJECTIVES

Direction is the hallmark of every instructional system. Whether the reason for the existence of a particular educational structure is to induct youngsters into the mysteries of a tribal culture, to train them to exercise technical skills in a world of specialized work, or to prepare them to apply complex cognitive processes to an infinite variety of tasks, goals may be found as guiding principles of the establishment. There must be purpose or there can be no organized process of education, and the underlying purpose of all education, formal or informal, is to bring about change in students.[1]

Within the open-door college, many forces effect such change. Counseling services help the student select from the many opportunities and paths available to him in the college and in the world outside. Student activities, planned and unplanned, temper him as he attempts to organize his life, his thoughts, and his beliefs. The whole campus community has an effect in ways which are still largely unknown.[2]

But it is for others, laboring elsewhere, to discuss the ways the many facets of college affect each student. These conference meetings are devoted to learning about various educational approaches which are applicable to college curriculum and instruction. More particularly, we will, at the end of the sessions, know something of the theories from which instructional systems are drawn, be aware of beginning attempts to apply systems approaches to junior college education, and learn of results and future directions in colleges in which these deliberate attempts to effect educational innovation have been made.

My own effort is to outline the core of a process whereby college courses and instruction within those courses may be arranged so that all is geared to institutional purpose. The process is one of defining instructional objectives in terms of observable change in the students.[3] Outcomes thus specified may serve as bases for the design of any educational system, innovative or conventional, automated or ordinary, as broad as the college's whole effort or as limited as a single instructional session. The construction and use of complete sets of objectives so defined can bring all curriculum and instruction sharply into focus, for the entire endeavor may then continually be weighed against institutional purpose—against that which is actually happening to the students.

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[1] Jack R. Frymier, *The Nature of Educational Method* (Columbus, Ohio: Charles E. Merrill, 1965), p. 7.

[2] Philip E. Jacob, *Changing Values in College* (New York: Harper & Bros., 1957), p. 114.

[3] The process was pioneered by Ralph Tyler and his associates at the University of Chicago during the 1930's.

BACKGROUNDS

The process of which I speak has not enjoyed a long history. One might consider that a need for defining instructional outcomes in terms of observable student change came into American education less than a century ago, at a time when providing a setting for the student dilettante ceased to represent the major purpose of colleges. As universities accepted a charge to train members of the professional community—architects, lawyers, teachers—programs of demonstrable relevance to students' future activities had to be built.[4] The democratic ideal of a form of higher education for all gave impetus to the process, for, as the doors swung open, it became increasingly necessary to define particular directions which each of the newly developing college programs would take.

One might also find a reason for specified instructional objectives in the scientism characteristic of the twentieth century. No more willing to accept on faith the phenomena of developmental processes in the human organism, we now try to understand and to predict patterns of learning. This is obviously impossible unless we first consider what is supposed to be learned.

Currently, some form of the art of specifying objectives is practiced in industrial and armed-services training schools and by writers of programmed texts. In each of these cases, it is impossible to design deliberate programs without considering the outcomes of the instruction. The equipment repairman must be able to make the machine operate after his training, the gunner must hit the target a specified number of times,[5] and the student who works through the program must answer the criterion questions correctly or the program has failed.[6] In all cases, the outcomes are specified before the instructional sequences are established.[7]

DEFINITIONS

In the preceding paragraphs, I have used several terms—purpose, goal, aim, objective—without clear referents. I would like to single out two of these terms and give them particular definitions. Let us say first that the term *goal* here indicates generally what is to become of the students who attend the junior college. It indicates the broad range of their abilities. Typical goals, for example, could be: (1) students will be able to communicate effectively; (2) students will understand scientific methodology; (3) students will learn to think critically; (4) students will appreciate American democratic processes; and so on, always considering that, in this case, educational goals indicate actions to be taken, skills to be learned, abilities to be gained, attitudes to be held or modified by the students as a result of their having attended the institution.

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[4] Frederick Rudolph, *The American College and University* (New York: Vintage Books, 1962), p. 244.

[5] Robert G. Smith, *The Development of Training Objectives* (Washington, D.C.: George Washington University, Human Resources Research Office, 1964).

[6] C. A. Thomas, *Programmed Learning in Perspective* (Chicago: Educational Methods, Inc., 1964), p. 37.

[7] Benjamin S. Bloom (ed.), *Taxonomy of Educational Objectives* (New York: David McKay, 1956), p. 26.

The second term to be defined is *objective*. An objective as used here is a specific, observable student action or product of student action. To satisfy our definition, it must, first, specify something the student is to do; second, state the circumstances under which he will do it; and, third, note the degree of accuracy with which he will perform the action.[8]

Notice that both *goals* and *objectives* indicate something which is to happen to the student; in the one case, implied attitudes or abilities to be gained; in the other, specific actions or definite products of student actions. Under no circumstance will we consider a goal or an objective to be something provided by the college or the instructors. To say, in this context, that a college goal is "to provide opportunity for students to fulfill themselves" or that an objective is "to offer courses which meet university requirements" is inappropriate. Those and similar terms come under the heading of institutional purpose and, as such, should not be confused with goals and objectives.

How can goals and objectives be established within the open-door college? It is not difficult once one accepts the premise that the basic reason for any education is to allow, or, if you will, cause, people to change. All instruction is designed to lead students to perform tasks they could not perform previously, to have them think different thoughts, dream different dreams. If it does not do that, or purport to do it, then it is not instruction but something else—call it "total experience without definable meaning" or "inward evolution" or by some term which identifies it as being process and product, means and end combined. Identify it, label it, and then ask honestly, "Is the providing of a setting for this indefinable something the *sole* purpose of the junior college?" If so (and I am not going to discuss here the full implications of a positive answer to that question), then any attempt to specify outcomes is meaningless—the process is its own product. If not, then some attempt to specify objectives must be made. Defining outcomes involves separating ends from means so that each may be considered for its own value.

I have gone to great lengths to define the terms *goals* and *objectives* because they must be recognized and dealt with apart from processes. They should not be confused with means and methods or with generalized and nebulous aims.

COLLEGE GOALS

Junior college goals are drawn from sources both extra- and intrainstitutional.[9] Whether programs are labeled liberal or general education, vocational preparation or community service, goals are influenced by board policies, social pressures, types of students, administrative orientation, and a host of other factors. Whatever the source of the goals, however, objectives may be derived from them. Rather than dwell on sources of goals I would explain how objectives may be generated from goals which stem from any source. For this purpose, I have selected a common goal as an example and will show how it may be broken into separate objectives.

"The student will be able to communicate effectively in writing." That goal, or one similar, stems from a commitment to general education and is broad enough to be found in most college statements of direction.[10] But objectives must be built, for several institutional needs are not served by the goal statement alone. Attempts, for example, to evaluate the college's success in effecting the designated ability in its students could not be undertaken on the basis of the goal as stated. Construction of curriculum might take any direction, for interpretations of effective communication vary widely. And instructional procedures could not be established with any assurance of direct relevance. The specification of objectives is prerequisite to all those undertakings.

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[8] Robert F. Mager, *Preparing Instructional Objectives* (Palo Alto, Calif.: Fearon, 1962).

[9] Clyde E. Blocker et al., *The Two-Year College: A Social Synthesis* (Englewood Cliffs, N.J.: Prentice-Hall, 1965), p. 205.

TERMINAL OBJECTIVES

An objective, you recall, must meet three criteria—it must specify a student action or product of such action, it must state the conditions under which the performance will occur, and it must establish a minimum performance criterion, a standard. There are many forms of writing which could be interpreted as "effective communication." For instance, if the student produces a coherent composition, he is giving evidence of his ability to communicate effectively in writing. To meet the first criterion for the objective then, we need to specify the type and approximate length of the composition and certain other pertinent facts. For example:

> The student will write a descriptive essay of 500–1000 words on a topic to be assigned.

That is the task performance by means of which the student shows he can communicate. Several other student actions may be derived from the same goal, for example:

> The student will write a 300–500 word set of specifications for construction of a model airplane.
>
> The student will write a 75–125 word description of one of twenty plants which may be found on the campus.

In each of these examples, the action to be taken by the student is specified. In each case, he is giving evidence that he can communicate effectively in writing and, in each case, the nature of the communication is specified in advance.

The second criterion is a statement of the conditions and circumstances of the action. Do we want our student to gain ability to write his paper in class in a specified period of time? Do we want him limited to the use of certain reference materials? Conditions may be stated thus:

> Essay will be written in two hours under examination conditions; dictionary may be used.
>
> Description will be written as an overnight assignment.
>
> Student will be allowed three days and all library resources to write the paper.
>
> Essay will be written in fifty minutes with no aids and no rewrites permitted.

We have established the circumstances under which the action will take place.

Having set the task and the conditions, only the standard remains to be specified. We may want to allow a few errors:

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[10] B. Lamar Johnson, *General Education in Action* (Washington, D.C.: American Council on Education, 1952), p. 140.

No gross grammatical errors (fragments, run-ons); not more than two errors in spelling and three in punctuation.

We may want the student to communicate effectively regardless of his grammar:

> Description will enable the instructor to identify each of the plants from a set of twenty pictures.

We may require that the essay be mechanically near perfect:

> No gross grammatical errors (fragments, run-ons); no errors in spelling or in punctuation.

Setting the criterion depends on many factors—importance of the task, previous abilities of the students, time available for instruction, and so on. The point is that some minimum standard must be included in each objective.

Put all together, here is an objective as it might be stated in practice:

> In a two-hour examination, the student will write a 500–1000 word descriptive essay on a topic to be assigned. No gross grammatical errors and a maximum of two errors in spelling and three in punctuation will be allowed. Dictionary may be used.

Note that there remains little ambiguity as to the nature of the task by means of which the student demonstrates his ability to communicate. Here are others:

> Given three days and the resources of the library, the student will write a 300–500 word set of specifications for construction of a model airplane. Specifications will be such that any wood-working student would be able to build and fly the plane.
>
> Given twenty pictures of plants, the student will write a 75–125 word description of one of them so that the instructor may identify the plant. Paper may include no gross grammatical or spelling errors. Dictionary will be allowed. Time: thirty minutes.

Note that in all these tasks terminal to a particular instructional sequence, the student is acting under a definite set of conditions when he demonstrates his ability to communicate. We are not speculating on whether or not or how well he can do it. His abilities to organize his thoughts, to handle language, to use rules of grammar, to spell, and so forth, are demonstrated in the task which he has performed.

INTERIM OBJECTIVES

After the terminal task has been specified, interim objectives must be built. What are the several abilities prerequisite to the student's writing a composition? One can think of dozens and each of them needs to be defined as a separate task. A set of interim tasks or objectives may be plotted so that the student is led to the desired end ability. As in the case of terminal objectives, each must meet three criteria—a task indicative of a gained ability must be specified, conditions under which the performance will occur must be noted, and a minimum achievement standard must be set.

Here are a few examples of objectives designed to demonstrate abilities prerequisite to the task of writing an essay:

1) The goal is that the student recognize appropriate titles:

> Given a 500-word descriptive essay and eight titles, two of which may be considered appropriate to the essay, the student will select one of the two titles. Time allowed, eight minutes. No reference work permitted.

2) The student must recognize the flow of ideas:

> Given six paragraphs, the student will order them in sequence appropriate to form a coherent composition. Time allowed, ten minutes. No reference works permitted.

3) Does the student understand paragraph structure?

> Given a paragraph and six possible topic sentences, the student will select the sentence which best applies. Five minutes, no reference works.
>
> Given six sentences, the student will, within seven minutes, order them in sequence to form a paragraph. No references permitted.

There are, of course, many more, but a critical point in curriculum construction is that each of the prerequisite abilities be itself stated as a specific objective. Only in that manner can checks be applied to the system at every point and the entire sequence of relevant experiences be efficiently directed and appropriately evaluated.

LONG-RANGE OBJECTIVES

A criticism sometimes applied to the process of specifying instructional objectives is that performances which may be tested in the classroom are too limited—that the truly important outcomes of instruction are exhibited in student behaviors beyond college walls. Defining long-range effect may, even so, be undertaken in terms of specific objectives. Tapping the student's mind directly to determine whether he has gained certain abilities is impossible—we instead arrange for him to perform certain tasks which we agree are indicative of his holding those abilities. A similar process applies to the attitudes which affect his out-of-class actions. *If* we accept the premise that the open-door college is charged with affecting attitudes, and once we agree on the nature of those attitudes—two rather significant assumptions—it but remains for us to arrange the curriculum accordingly and to determine from the student's actions whether and how his feelings have been affected.

A long-range goal sometimes found in college catalogs is "the student will exercise the privileges and responsibilities of democratic citizenship."[11] Again it is not my purpose to argue for or against the statement as a definition of purpose, but it seems sufficiently broad to be generally acceptable. What remains is to translate the goal into operational terms—into one or more specific objectives.

Many behaviors may be indicative of students' exercising the responsibilities of citizenship. Voting is one. Consider this specific objective:

> The student, if eligible, will voluntarily register to vote within the six months following the course.

We have an action suggesting an attitude, the circumstances (voluntarily, within six months), and a criterion (either he registers or he doesn't). A specific objective has been derived from a general goal.

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[11] College of the Desert, *Catalog and Announcement of Courses* (Palm Desert, Calif., 1963), p. 4.

Here is another behavior which might stem from a similar attitude toward democratic processes:

> Prior to the next general election, the student will voluntarily campaign for a candidate by working in his office or distributing handbills for a period of not less than forty hours.

The student is acting in a particular manner, the conditions (voluntarily) are indicated, and a criterion (for not less than forty hours) is suggested. There is little ambiguity about whether or not the student has gained the desired attitude; he is indicating by his actions that he has.

The issue of acquired tastes also arises in discussions of curricular organization. We may want our students to gain appreciation for forms of art other than those commonly presented in the popular media. Consider these objectives:

> Within the next year, the student will voluntarily attend three legitimate stage productions.
>
> The student will voluntarily purchase two books of contemporary poetry within the six months following the course.

The behaviors, the conditions, and the criteria are all specified.

These and similar objectives may be built for particular courses or they may be part of a departmental charge. In all cases, however, the first consideration is to determine what observable student actions we will accept as indicative of certain attitudes. We may then set out to plan interim objectives designed to lead the student in the desired direction. It may not always be expedient to collect data on the achievement of out-of-class objectives. Nevertheless, they should be deliberately constructed, for they serve as excellent guiding principles for curriculum development.

CONSIDERATIONS

There are many variables to consider in defining objectives. Here are a few:

1) What is the relative importance of one objective to another, to the total of all college objectives?

2) How pertinent is the objective to the community from which the college draws its support?

3) What are the base abilities of the entering student population?

4) What per cent of the students enrolled in a particular program will reach certain objectives?

5) How relevant is the objective to the student this year? Five years from now?

These and other factors must be assessed time and again as objectives are constructed and revised. Defining objectives for the two-year college is not a one-time task. It must be done continually at regular intervals and it should be undertaken by everyone who has concern for the curriculum and for instructional processes. Consider the advantages:

1) A continuing dialogue on institutional goals and purposes will ensue—a dialogue based on actual outcomes.

2) Gaps and overlaps in the curriculum may be identified and reduced. Is the college committing too much to certain goals, not enough to others?

3) Organizational patterns and physical-plant arrangements may be planned in terms of what is really happening to the students. Resources may be appropriately directed.

4) Methods and media may be selected and used according to their demonstrated value. A whole basis for experimentation can be established.

5) The giving of grades may be made relevant to actual, defined accomplishments. Marks will take on particular meanings.

6) Student self-study may be economically and appropriately directed.

Determining complete sets of specific objectives and communicating them to students may be the single most significant thing an instructor can do to effect learning.[12]

The process is not without its pitfalls. For one thing, ambiguous goals and aims have great defensive value. It is impossible for a critic to snipe at a college program with any great degree of accuracy if he does not know what the program is designed to accomplish. If we say the students will learn to communicate effectively, to think critically, and to appreciate democracy, and stop short of translating those goals into specific objectives, who can say that the students do not so communicate, think, and appreciate? The accusation that they have not reached those fortunate cognitive and affective states of mind is easily rebutted if for no other reason than that the charge must be based on terms and data capable of widely varying interpretation.

A corollary to be considered here is that once outcomes are specified, the college must stand ready to defend each of them. There is a public relations plus in nebulous concepts. Anyone who challenges the college's statement that it intends to lead its students to "exercise the privileges and responsibilities of democratic citizenship" is attacking *Flag Day* and the *Fourth of July*. But translate that exercise into particular habits of voting, campaigning, and becoming involved in public issues, and someone in the community will not approve. Once communicated, specific objectives will be questioned, and the more successful the institution is in bringing its students to the ability to perform the designated tasks, the more intense the questioning will become. Paradoxically, ambiguity, inefficiency, and instructional procedures of unknown effect are, in this case, institutional strengths.

There are matters of internal import also. Once objectives are spelled out in specific, measurable terms, instructional methods will become considerably more efficient. Having gone through the deliberate process of constructing the objectives, instructors will become intensely aware of what they are trying to do and seek more appropriate ways of doing it. They may wish to prepare replicable media, so that when they find effective means of meeting their objectives they can use the materials again. Staff requests for mechanical equipment will be weighed on the basis of demonstrable value. One or more measurement specialists will have to be assigned to help the faculty gather evidence of student achievement. The work of the college research director will gain new dimensions, for it will then involve much more than his computing grade-point averages to the second decimal place. These matters represent adjustments which can and should be made within the framework of existing educational structures as junior colleges proceed to define outcomes.

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[12] Paul Douglass, *Teaching for Self-Education as a Life Goal* (New York: Harper & Bros., 1960), p. 29.

I have listed some of the considerations which arise once objectives are defined, because the system is so very different from that in most of our educational institutions. Specifying objectives means separating process from product in the classroom. It means examining student change rather than teacher performance. It means sharpening our views of students—looking past their implied abilities to their specific actions, beyond their unknown attitudes to their observed behaviors.

CONCLUSION

The process of defining objectives is neither a fad nor a mere transient approach. It is a deliberate attempt to focus instructors' and administrators' attention on their actual intent—and for timely reasons. Formerly, when instruction was all lecture-textbook, learn or don't, it was so ill-defined that it was immune to assessment. Learning took place in or out of class, few knew or cared particularly. It was easy to hide behind the "normal ability curve" and to say "We put it before them, sorry if they were unmotivated to learn."

But changes have occurred. Our institutions are filled with all types of students, and it *is* possible to teach them, for we know much more about human learning than we did a generation ago. It is feasible, for example, to arrange instructional sequences so that a measurable change comes about; to alter instructional forms in accordance with the nature of the tasks the student will be asked to perform; to design and to effect change.[13] As materials of a programmed instructional nature become better developed and more widely used, the process of influencing outcomes will become quite familiar in all colleges.[14] And as computer-assisted instruction becomes a reality, the ultimate in directing learning will be achieved.[15]

Will junior college educators lead in the process of demonstrably effective education? Defining instructional objectives is only the first step, already overdue. Will instructors specify the goals of their own instruction? They must work through the process in their own courses—build the objectives, specify the outcomes, collect the evidence—or be guilty of abandoning to others the responsibility they implicitly accepted when they entered the profession.

What is offered here is a set of tools for use by people concerned with what happens in education. It is not necessary for one to accept an instructional system based exclusively on defined goals; the indefinable, the unmeasureable will be with us, I expect, for generations. But as beginning points for assessing impact of the curriculum, as minimum levels to which we can commit our resources, specific instructional objectives must be considered by everyone in the two-year college.

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[13] Robert M. Gagne', "The Analysis of Instructional Objectives for the Design of Instruction," in R. Glaser (ed.), *Teaching Machines and Programed Learning* (Washington, D.C.: National Education Association, 1965).

[14] B. F. Skinner, "Teaching Machines," *Scientific American*, November 1961.

[15] John Coulson, "Automation, Electronic Computers, and Education," *Phi Delta Kappan*, XLVII, No. 7 (March 1966), 340–344.

SECTION II

Experiments and Experiences

ROBERT E. CORRIGAN

DEVELOPING AND VALIDATING INSTRUCTIONAL MATERIALS THROUGH THE INSTRUCTIONAL-SYSTEM APPROACH

Scarcely any prediction of the future of education, or evaluation of the impact of new technology on educational processes and product, fails to consider the significance of the population and knowledge explosions. These factors are and will continue to be the driving forces behind our attempts to better understand the nature of learning and to use this knowledge to streamline our educational content, methods, and media.

There is no need to dwell on these factors, however, since we are well aware of the *problems* facing us. Our concern is the *solution* to these problems and, specifically, the role of the system approach in providing these solutions. Questions to be answered here include:

1. What is the relationship of the system approach to the development and validation of instructional materials?
2. What is the instructional-system approach?
3. How can the system approach be applied in education?
4. What is the role of the system approach in developing instructional materials?
5. What does the process of validation involve?

RELATIONSHIP OF SYSTEM APPROACH TO INSTRUCTIONAL MATERIALS

The development of valid and meaningful instructional materials is totally dependent on the system for which they are developed and, thus, from which the need for them was derived. In discussing the development and validation of instructional materials, then, we must also consider the broader topic of the system approach. If any instructional objective is worthwhile, it will have been proved so by the application of the system approach. Valid objectives and, thus, valid instructional materials are the product of the system.

The term *programmed* has come to be typically associated with paper programs and teaching-machine programs. Consequently, the term *validation* has been tied to the process of trying out these types of materials. These are unrealistic and misleading restrictions. *Programmed instruction* is a term that must be broadened to include the methodology for developing *any* instructional material. Programming *is* the system approach to developing subelements of the total system regardless of the specific method or media used.

Therefore, when we talk of developing instructional materials, we are talking of *programming* instructional materials.

As a performance system, programmed instruction provides:

ORGANIZATION

1. Measurable performance objectives
2. Specific, relevant content
3. Sequence and step size appropriate to the learner
4. Measurable performance required

COMMUNICATION AND CONTROL

5. Active student participation
6. Effective feedback and reinforcement
7. Pacing controlled by demonstrated student comprehension

PERFORMANCE MEASUREMENT

8. Correction of student errors immediately
9. Continuous recording for strategy planning and diagnosis
10. Continuous recording to process achievement records

THE INSTRUCTIONAL-SYSTEM APPROACH

If we accept a generalized definition of *system* as a group of components or subsystems, each performing significant roles and functions contributing to the end product of predictable achievement, then education or instruction can be identified as a system—a rather complex system. The end product of the educational system is predictable achievement in terms of student performance. All components of the system—students, administrators, teachers, facilities, methods, materials, and support groups—act as components or subsystems performing significant functions to produce learning.

The instructor, the student, and the materials are the most visible components of the over-all instructional system, because it is in this setting that learning takes place and tangible results are produced. Implementation, however, is only a small segment of system operation and could not occur without the functions performed by all other subsystems—administration, curriculum planning and design, material production, performance evaluation, and so on.

Through rigorous formal methods of analysis, the system approach results in the identification of all functions and tasks required to achieve the *terminal-performance objectives*—the end behavior desired of the student. The system approach is a process of design and control for:

1) establishing the objectives of a system in precise terms;
2) identifying the functions which must be performed to achieve the system objectives;
3) determining how these functions may best be performed;
4) organizing resources into an integrated, smooth-running system; and
5) implementing, checking the efficiency of, and making necessary adjustments and corrections in the operating system based on recognized deficiencies or changing requirements.

THE SYSTEM APPROACH IN EDUCATION

Of course, the term *system* has many levels of application. A system may be the educational program of an entire state, for example, or it may be the smallest segment of a course. To an instructor, one course may be a total system, while to the administrator, it is a subsystem. The system approach is applied from the standpoint of administration, logistics, and curriculum development, and from the standpoint of the interrelationship and integration of all of these elements. Regardless of the reason for applying the system approach, and regardless of the size or scope of the system under consideration, the basic methods and procedures are the same. Although we are concerned here with its application to curriculum—to the generation and validation of purposeful, effective, and efficient instructional materials—we cannot ignore curriculum as a *subsystem* of the larger system from which the requirements for specific materials are derived.

As a system, the educational institution, too, must clearly identify its role as a *subsystem,* in this case, a subsystem of the total system within which it is to operate. What specifically are its goals: To prepare transfer students for higher education? To train terminal technical or vocation students? To provide adult education? For what purpose? In what fields? How do these objectives relate and integrate with other components of the total system, such as industry, the community, or society as a whole? When these and many other questions about mission objectives have been answered, the instructional system to achieve these mission objectives may be designed.

THE ROLE OF THE SYSTEM APPROACH IN DEVELOPING INSTRUCTIONAL MATERIALS

The ultimate goal of the learning process is the achievement of relevant performance skills by the individual learner. Thus, the focal point of the educational system is the *learner.* To prepare the individual adequately, the educational system must answer some very specific questions:

1. What must the individual learn to assure success in the "real world"?
2. How can we assure continuous, up-to-date sensing and defining of relevant learning objectives in the changing "real world"?
3. What "model" of instruction provides the most efficient process to assure successful and meaningful achievement by the individual according to his specific needs?

The answers to these questions provide the basis for developing and validating instructional materials. These answers are provided by the rigors of system design and are produced through the following process:

1. The vocational-educational requirements for specific skills and knowledge are appraised. This involves the analysis of real-world employment and societal requirements, and the analysis of existing course structure and content for appropriateness to these needs.
2. From this analysis is produced a definition of the need-to-know functional performance requirements—the gross tasks which must be learned for successful future achievement—organized and grouped homogeneously. These generally result in the formulation and design of disciplines and courses.
3. This process of analyzing and breaking tasks down to more finite specifications of terminal behaviors in "doing" terms continues to the point that an entire course is described in behavioral objectives. These objectives, and

criterion test items based on them, provide the basis for evaluating the success of any instructional materials.

Successful, controlled achievement by individual learners demands the selection of only relevant skills and knowledges which, on completion of training, assures success on the job and in the community. The development of curricula and of instructional materials must be based on a strategy that will insure successful achievement during all phases of instruction. This is the role of the system approach in the development and validation of instructional materials.

The instructional systems approach is a self-adjustive performance system. It is designed to achieve carefully established learning objectives for students who possess the prerequisite skills for entrance into the instructional sequence. It is based specifically on the predefinition of (1) what is to be learned, (2) the required levels of terminal or final proficiency to be achieved by the learner, and (3) the most appropriately designed instructional steps to insure the success of learners on each step leading to the prestated terminal performance objective. (Design in regard to instructional steps refers to the most appropriate sequence and method/media of presentation.)

The total emphasis is the designed, predictable achievement of prestated terminal performance specifications representing only the relevant concepts, principles, and techniques required for "knowing" and "doing" skills.

Of critical importance in designing the instructional system and identifying the need for specific instructional materials is the prespecification of the "critical or functional learning path" leading to the achievement of the predefined objectives. This path is limited to need-to-know learning requirements, and to only relevant demonstrations and exercises, to establish and reinforce the concepts to be learned. It prescribes the sequence and order of presentation of instructional components to be included as integral parts of the learning sequence; establishes the role of instructor and student in each instructional setting; and, of great significance, indicates the means for controlling the pace of instruction based on the measured understanding of individual students for progressive steps along the path.

The functional learning path is developed through a series of analyses. Each successive analysis phase results in a more finite statement of what must be known or done by the learner. Each level of objective is analyzed to derive more specific objectives until a level is reached that will provide the guidance necessary for the development of instructional materials to produce the terminal performance in the student. Criterion measures or test questions are stated for each objective. These provide measurement not only of student achievement, but of materials and methods as well.

Only after the functional learning path has been established can method/media decisions be made. Determination of method/media combinations will depend on stimulus-response requirements of the learning tasks. Based on the type of learning involved, the level and depth of learning desired and the degree of fidelity or realism required, what is the best instructional method to be used? Through which media should it be presented?

Media selection is often affected by the limits and constraints of the overall system. The optimum in method/media is weighed against real-world economics—the capabilities of the system. The decisions thus made result in the total course design. It remains, then, to design, develop, validate, and implement the materials.

What the student must know and do is specified through the analysis phases. How the student will achieve the knowledges and skills is determined by the method/media decisions. The next step requires synthesis of all specifications in selecting and developing materials.

For some learning steps, existing or "off-the-shelf" materials might meet specifications. Often, new materials must be designed and developed. The latter might require technical experts, personnel skilled in programming and audio-visual techniques, and faculty members specially trained in the system approach. Development of other materials might be subcontracted to industrial organizations which have personnel and facilities to meet the requirements.

Developing materials for the instructional system is one of the most critical phases of system design. All analyses have been directed toward specification of finite activities on the learner's level leading toward his achievement, and specification of criteria for measurement and conditions for performance. The materials generated must reflect all the aspects of the analysis. The materials furnish the point of contact with the student. The materials must communicate clearly; must apply the optimal methods; must be logically sequenced at the student's level; must allow for active response and feedback to the student, the instructor, and the designer; must be designed to provide practice, reinforcement, and motivation; and must be flexible enough to accommodate for individual differences in learners.

OAKLAND COMMUNITY COLLEGE—AN OPERATIONAL MODEL

Probably the best way to illustrate this process is to describe how an operating system was developed. Such a system is Oakland Community College, a junior college complex in Bloomfield Hills, Michigan. In 1965, O.C.C. opened its doors as the only institution fully committed to the instructional system approach applied to administration, management, curriculum design, and instruction.

Prior to the enrollment of the first student, O.C.C. went through the rigors of system design I have described. The mission objectives were stated in terms of the role of the college—presenting continuing education, technical-vocation, developmental, and transfer programs according to the needs of the community. With these basic objectives in mind, the staff analyzed the needs in these areas through consultation with employers and other educators, in the light of their own experience in the various fields. From this analysis they established the disciplines and courses necessary to fulfill these needs. Further analysis of specific skills and knowledge areas produced detailed course outlines in terminal student-performance terms—what the student must know and be able to do after completing a course or a specific segment of a course. This process included the development of criterion examination items, based solely on the performance objectives established, these items to be used to measure the effectiveness of methods and materials and to assess student progress. Detailed objectives so developed were constantly checked against the more gross objectives to insure that their intent was being carried out. The detailed analysis also identified deficiencies in the higher-level objectives, and precipitated revisions.

Once the specific objectives had been established, they were analyzed to identify the type of skill required of the student and the degree of fidelity or realism required. This analysis provided the basis for the method/media selections. The need for audio-visuals, printed handouts, programmed texts, regular textbooks, and the like, was derived from the course objectives. When necessary, cost effectiveness compromises were made, and the final method/media decisions initiated the process of material development.

The design of instructional materials begins with an analysis phase of its own. In this phase, the writer analyzes the specifications in detail, breaking them down to their smallest identifiable elements—just exactly what the student must be able to do. During the analysis phase, the designer answers questions such as: What terms must the student understand and be able to use? How are the subelements of an objective interrelated? How and in what sequence should information be presented? What types and levels of learning are involved? What types of activity, mental and/or physical, must the student perform for the most effective and efficient learning? What, in other words, are the responses to be elicited, and by what stimuli are they to be elicited?

The criterion test questions serve as guideposts for the development of meaningful instructional materials. However, during this analysis phase, even more detailed criterion devices are developed to guide the development of a sequence of instruction and to measure student achievement of significant bodies of subject matter.

Once the subject has been analyzed and structured thoroughly, and criterion measures have been established, the writer develops his strategy (which is similar to the method/media decision described earlier). Based on the type of learning involved, the type and form of the stimuli and responses, he makes tentative decisions about the type of student activity he will require for a particular learning sequence, the form of the response, and so forth.

In the planning and strategy phase, the writer considers also the design of the total system. Just what is the student when he reaches this particular point in the course? What skills and knowledge does he possess? How can this be used beneficially to enhance the instruction at hand? What can be done to bring the student to threshold level if he does not possess the prerequisites? What is the responsibility of the unit or course in preparing the student for planned future learning, and how can this best be achieved? How can the new material be organized and segmented to make learning and study more efficient and convenient for the learner? At what points should the student have an opportunity to assess his own progress, and at what points should the student be assessed for progress and understanding? The student will wish to review at times—how can the materials be structured to facilitate this? Feedback (confirmation of a correct response, remedy for an incorrect response) is critical to effectiveness of materials. How can it be provided so as to withhold the information until the student is ready for it? Students progress at various rates and may even require different approaches to the same subject matter. How can such factors be provided for and still fit in with the scheduling, evaluation, and administrative constraints of the over-all system?

These and other considerations affect the development of instructional materials. They went into the design of the O.C.C. system in order to provide the optimum learning environment for the learner.

VALIDATION OF INSTRUCTIONAL MATERIALS

Validity, in testing and measurement, is the degree to which an instrument achieves what it purports to achieve. Thus, validation is the process whereby instructional materials are evaluated to determine to what extent they achieve the purposes for which they were developed. This process in no way implies evaluation of the usefulness or appropriateness of the objectives. Such evaluation must be done in the design phase, before the materials are developed.

Validation, in its truest sense, is a complex and laborious process. It is not simply a spot check of the over-all effectiveness of an instrument after the fact. It begins almost as soon as pencil is put to paper and continues for the life of the instrument. As long the variations occur in the students in the program, in the environment in which it is used, or in any other aspect of use and administration, validation is necessary. However, I will restrict myself here to the validation associated with producing the first operational model of an instructional presentation.

Obviously, to prove the validity of any instructional material, standards must exist. These standards exist in the form of the objectives and their corresponding criterion examination items, and in the more detailed criterion measures mentioned earlier. In the case of programmed instruction, these more detailed criterion measures are often called *criterion frames*—frames which are strategically placed in the sequence of instruction to check the students' comprehension of a particular concept and, thus, to check the effectiveness of the sequence. Whatever the name and whatever the type of instructional material being devised, these measures should weigh heavily in the validation process, and the product must be continually checked for its achievement against these standards.

Validation is on-going throughout the development process. From the beginning, the writer guides the students to criterion achievement. As he develops sequences which he feels will achieve this, he will try them out, often on a one-to-one basis with a student. Once the total package has been through the process, and the confidence level is high, the package is validated on progressively larger groups of the population, being refined and shaped as deficiencies in student achievement are noted. At some point, when the unit achieves acceptable standards, it is a "final" product, ready for introduction into the operating system.

CONCLUSIONS

The system approach is a logical process of analysis and synthesis. The rigors of system design force the identification of specific objectives and goals at all levels and, as elements of the system are implemented, assures the constant evaluation and iteration (checking back) of the many elements of the system to one another to insure that they are compatible, consistent, and properly integrated. The system approach provides a constant, on-going goal and performance evaluation, so that the system is up to date in its mission objectives and achieves these objectives adequately.

In regard to curriculum and instructional-materials development, system design produces learner-oriented, behavioral objectives based on the true needs of the learner. These objectives guide the development of instructional materials which will produce in the student the behavior *known* to be required in the profession or vocation of his choice.

With such detailed and specific guideposts, the developer of instructional materials has the tools whereby to measure effectively his progress in achieving the objectives and in evaluating the success of his materials. He constantly evaluates student achievement in relation to these objectives, making adjustments and corrections where lack of student success indicates the need. In this manner, the system approach to education insures valid, educational goals and curriculum content, and efficient, effective achievement of those goals in terms of a consistently high level of significant student achievement.

S. N. POSTLETHWAIT

AN AUDIO-TUTORIAL APPROACH TO TEACHING BOTANY

HISTORY OF THE AUDIO-TUTORIAL SYSTEM

The audio-tutorial system began approximately five years ago at Purdue University as an attempt to make some adjustment for the diversity of backgrounds of students in a freshman botany course. The course involved 380 students and was a four-hour credit course. It mainly served freshman students in the Schools of Pharmacy and Agriculture. These students had attended a great variety of high schools, so that some had received very excellent training and others relatively poor training. Students with equal capacities could not perform equally well because of this difference in background. To assist the students with poor backgrounds, a special lecture on tape was made each week and filed in the audio-visual library.

Students presumably would be able to compete more effectively after hearing the supplementary lectures. During the preparation of these lectures, it occurred to me that the students might relate subject matter in the text to that covered in the tape lecture. Later it seemed logical to use their laboratory manuals in connection with the taped lectures. Still later it seemed feasible to provide the student with plants and experimental materials so that these too could be related to the laboratory manual, textbook, and tape lecture. Ultimately, the discussion on the tape was no longer a lecture but rather a discussion on a one-to-one basis, one teacher–one student, in which I was *tutoring* the student through a sequence of learning events. The tape was prepared by arranging the various learning items on a table before me, and I talked into the tape recorder as though I were helping a friend to study. Learning events included a great range of experiences: reading from the text, experimenting, collecting and analyzing data, manipulating a microscope, watching a time-lapse movie, observing plant specimens, charts, diagrams, and photographs, and listening to brief lectures or discussions. The success of the initial tapes encouraged me to run an experiment with thirty-six students for one semester that further confirmed the potential of the audio-tutorial system. At the end of the second semester of experimentation, I met with these students to restructure the botany course, disregarding all traditional limitation and placing total emphasis on student learning. We would eliminate all busy work and attempt to adapt the method of presentation to the nature of the objective.

THE RESTRUCTURED COURSE

The restructured course included the following study sessions: one hour per week—General Assembly Session; one-half hour per week—Integrated Quiz Session; and an indefinite number of hours per week—Independent Study Session.

The Independent Study Session (ISS) involves the student in a great variety of learning events. Basically, these events are programmed in the voice of the senior instructor through the use of audio tape. This study session is conducted in a special learning laboratory which is open from 7:30 A.M. to 10:30 P.M. Monday through Friday. The student comes in at his convenience and as frequently as he wishes. He studies until he feels that he has mastered the subject matter and he is free to omit or repeat any part of the study. An instructor on duty gives assistance when asked and attends to any routine matters that arise. Twenty-eight to thirty booths in one learning laboratory accommodate five hundred students for the equivalent of four hours of conventional contact time. Each booth is equipped with a tape player, appropriate audio tapes, an 8-mm. loop film projector, a microscope, live specimens, and any other material pertinent to the week's work. All booths are set up identically. The student is tutored by the senior instructor through a series of learning events, which may include listening to the senior instructor introduce the week's work, reading specified materials, comparing specimens with diagrams, examining specimens, doing experiments, collecting data, and any other activity that may be useful to him in the learning process. Material too bulky to be included in the booth is placed on a demonstration table, and the student is requested to use such materials in the appropriate sequence by turning off the tape and going to a specified location.

Long experiments or small research projects are directed through the use of mimeographed materials. Two such projects are required during the course of the semester. Full instructions are given for the first problem and progressively more is left up to the student with each successive problem. Each project is written in the style of a research paper and requires the reading of original research.

The General Assembly Session (GAS) allows the senior instructor to express his personality and to set an intellectual tone for the course. The students can accomplish those learning experiences which can best be done vicariously in large groups. For example, guest lecturers and long films are presented in this session.

The Integrated Quiz Session (IQS) is a modified seminar and oral quiz consisting of eight students seated informally around a table with one instructor. The instructor is supplied with the various items included in the learning center the preceding week, and these items are used as a basis for student discussion. All students are asked to discuss the items in turn and are asked to do so in a specified pattern or format. First, the item is to be identified; second, the student is to tell its role in the week's work or objectives; and third, the student is to explain how it fulfills this role. These items include a great variety of materials, such as plant specimens, a microscope, 2 × 2 slides, diagram or chart, a time-lapse movie, all or parts of experimental equipment, or any other materials which have been used as a subject of study during the preceding week. The student's performance is evaluated immediately on the basis of 0–10 points. If the instructor is very impressed, the student is placed in the category of *excellent* and receives a score of 9. If the instructor is not very impressed, the student is placed in the category of *mediocre* and receives a score of 7. If the instructor is unimpressed, the student is placed in the category of *poor* and receives a score of 5 or less. Six is a passing score, and all scores are subject to change as the discussion continues. Any student may comment on any item, and the instructor may raise his score accordingly. The items are distributed to the students in sequence, so that the theme (or themes) of the week are clarified and experiments lead progressively from experiment A to experiment B to experiment C, and so on. This progressive relationship is retained during the session. This session has been an effective feedback mechanism for informing us of the success or failure of any program sequence of experiments and often provides clues for improving our approach. It also helps to clarify the appropriateness of the communication vehicle used in attempting to achieve the objective. It turns into a miniaturized seminar and thus enables many students to see relationships and concepts which were not evident from the Independent Study Session earlier. The IQS is also an effective tool for preventing procrastination on the part of the students.

EFFECTIVENESS OF THE SYSTEM

Two questions most commonly asked concerning the system are:

1) Have we not now eliminated the personal contact important for motivation?
2) Is this not now a "spoon-fed" type of operation in which there is no opportunity for student discovery or inquiry?

In answer to the first question, personal contact is actually enhanced. We have now relegated much of the routine of teaching to a routine vehicle and the teacher's time now can be devoted to meaningful personal contact. The opportunities for personal contact are as follows:

a) as in the conventional lecture system, the senior instructor is available at the General Assembly Session for this kind of personal contact, such as it is;
b) in the Independent Study Session an instructor is available to give direct attention to individual needs on a one-to-one basis for any problem requiring instructor assistance. Also in this session students may visit with instructors about any additional aspects of the subject matter they find interesting;
c) the IQS provides an opportunity for every student to become well known by at least one instructor in the course, and for every student to know at least one instructor very well. An additional opportunity is available for every student to know many instructors well, though there is no alternative but to become well acquainted with at least one instructor.

The second question, concerning inquiry, is also answered in the affirmative. First, however, may I define *levels* of inquiry? Inquiry occurs at various levels, with the maximum or first level of inquiry represented by research. The second level of inquiry is experimentation which can be completed in the span of a three-hour laboratory. The third level of inquiry is one in which the busy work of experimentation is completed by the instructor, and the student is asked to collect and analyze data from the results. The fourth level of inquiry is to provide the student with data and ask him to analyze these data. The fifth level, of course, would not be real inquiry but merely a demonstration.

All of these levels of inquiry are feasible under the audio-tutorial system. At the first level, we ask our students to do two miniature research projects, the first of which requires our guidance throughout the project and the second of which is left totally to the initiative of the student. In the first project, the problem is defined, the materials and methods are described, the student is told what data to collect, and he is asked to analyze these data and write up the project in the format of a scientific paper. The second project is completed by those students who hope to make an "A" in the course, and here the student is restricted only by the materials available to him. He defines the problem, decides on the experimental procedure, what data to collect, analyzes these data, and writes up his project in the form of a scientific paper.

At the second level of inquiry, a problem is defined for an experiment requiring two to four hours and is done in the ISS as well as under the audio-tutorial system or under the conventional system. The subsequent levels of inquiry are also handled effectively in the ISS. The results of the A-T system have been positive from every point of view. Better instruction can be given with equal or less staff and space. Grades and student interest have improved at all levels. Costs are reduced for equivalent levels of instruction.

SUMMARY

May I take a few moments to discuss the philosophy of the audio-tutorial system as I see it, in retrospect, after five years of experience? It is sometimes said that "teaching is an art." This may be true. However, "education" should be a "science." The scientific method demands that one begin by defining the problem. The problem in education, simply stated, is that "learning must be done by the learner." While this is not a very profound observation, it stands to reason that if learning is done by the learner, the educational system should provide activities requiring student involvement. Both teacher and student alike should be concerned with the kinds of activities and situations that contribute to learning. If these activities and situations can be identified, the teacher is obliged to provide a course structure that permits the student to engage in these activities, and the student is obliged to engage in them conscientiously. Below is a list of some of these activities and situations as I see them.

1. *Repetition.* There is little question but that the nature of many objectives require repetition for their achievement. However, repetition ought to be presented in an intelligent fashion and be adapted to the individual needs of a particular student. For example, a student who has learned about the Krebs cycle in high school biology has little need for extensive repetition of this study in a college biology course. On the other hand, a student who is encountering the Krebs cycle in his college biology course for the first time may find it necessary to repeat this study or certain portions of it a

great many times. In a course with five hundred students, the teacher cannot possibly adjust repetition to individual student need. Only the student can determine intelligently how much repetition is necessary.

2. *Concentration.* Most classrooms are not organized to permit students to concentrate during their study. Students distract one another, and other, disassociated events may occur to divert the student's attention from the subject at hand. The audio-tutorial system isolates the student from the surrounding environment by covering his ears with earphones and placing him in a booth to reduce his awareness of his surroundings.

3. *Association.* In a study of plant science the major objective is to learn about plants. Therefore, a study of plants should be conducted where plants are available for observation. Diagrams, charts, models, photographs, and other such devices should be "a means to the end" that students direct their attention to the plant itself. The audio-tutorial system provides the student a plant at the time he reads about it and does experiments.

4. *Appropriate-size units of subject matter.* People vary considerably in the amount of subject matter they can grasp in a given amount of time. Programmers have demonstrated that most people can learn almost anything if it is broken into small enough units and the student can take time to become informed about each unit before proceeding to the next. Any program of study, therefore, should permit each student to adjust the size of the unit to his own ability so that those who can absorb large quantities of information may do so in an unrestricted fashion and others may proceed more slowly. The audio-tutorial system allows the student to proceed at his own pace and to break the subject matter into units commensurate with his ability. This is especially important where the learning events are sequenced with subsequent events that depend on a mastery of preceding ones. The human mind, with its limited attention span, is frequently distracted during the presentation. If distraction occurs at a point that is particularly critical to subsequent units of information, the student's deficiency may frustrate the subsequent learning experience. Presentation of material over a long span of time may result in progressively increased frustration such that the student assumes the attitude that the subject matter is too difficult for him. In order to maintain status with his peers, he may develop an attitude of "I don't want to learn this material" simply as a defense mechanism. Experiences such as this throughout several years of exposure to formal education may cause many educatable people to develop mental blocks which are difficult to overcome. The same information presented to the same student in a setting where the student can make each foundation idea firm before proceeding to the next can result in successful learning. "Success begets success" and successful experiences will usually encourage the student to greater achievement. The educator could well afford to learn from the successful construction engineer who first pours a concrete foundation that is carefully shaped and positioned to support the future structure and then permits this foundation adequate time to become fixed or firmed before placing on it the subsequent materials. Bricks and mortar are laid alternately, with each brick and measure of mortar carefully placed to provide a bed for the positioning of the next bricks to be laid. Only in education do we pour forth the units of subject matter along with the cementing

materials at a fixed rate, mixing together the bricks and mortar without regard to the many other factors which may affect the resultant organization.

5. *Adapting the communication vehicle to the objective.* Botany is a complex of various subject matters and requires a great variety of learning experiences. These experiences may include handling plant specimens, watching time-lapse films, viewing photographs, reading textbooks and journal articles, listening to discussions by the senior instructor, visiting with colleagues. No single vehicle, such as a lecture or a textbook, can achieve the full spectrum of objectives for this complex subject. The student's experiences should not be confined to 8-mm. film, audio tape, or any other of the great variety of communication devices which are now available to us. In cases where the development of a procedural skill is necessary, there is no substitute for the student doing this procedure himself. A properly structured course, therefore, would carefully define objectives and not try to mold objectives to fit a favorite medium (lecture, for example); it would use the medium best adapted to the objective. The audio-tutorial system permits this kind of student participation and enables one to bring to bear the correct medium commensurate with the objective.

6. *The use of multimedia.* Individuals differ in their responsiveness to different kinds of communication. Some people learn well through reading, some by auditory communication, and others by literally handling specimens and doing experimentation. While some of my colleagues think that intellectual achievement is accomplished only through reading, it is my opinion that many poor readers are as intelligent as good readers and may become literally more knowledgeable than good readers if they are permitted exposure to subject matter through a communication vehicle more suited to their receptiveness. The audio-tutorial system thus provides an opportunity for subject matter to be covered in a great variety of ways, with the student exploiting that medium which communicates most directly and effectively for him.

7. *Integrating the learning activities and situations.* The significance of integrating learning events was brought abruptly to our attention by an accidental positioning of two experiments. Subject matter from experiment A was necessary for understanding the subject matter of experiment B. For a number of semesters the students had had little or no difficulty transferring information from experiment A to experiment B. One semester, however, I noticed that more students were having difficulty with this transfer of information. In tracing the possible causes for the difficulty, I discovered that during the preceding semesters experiment A and experiment B had been in close proximity. Some new materials inserted in the course had forced the placing of experiment B on the opposite side of a demonstration table from experiment A. Although this distance was little more than three feet, the disassociation in space resulted in fewer students being able to transfer information from experiment A to experiment B. It stands to reason then that if this disassociation is extended in space by an even greater distance, still fewer students will be able to make the transfer of information. One can extrapolate further and assume that if the disassociation is not only in space but in time as well, still less students will be able to transfer the information. While the proximity of positions of materials is not a very

intellectual challenge to a teacher, this experience served to emphasize that many of the students' problems are not caused by the difficulty of subject matter but rather by these relatively simple factors. It stands to reason that if learning events are to be complementary and to have some relationship, they should be brought into close proximity and properly sequenced. The conventional structuring of a lecture, recitation, and laboratory does not take this into consideration but rather may expose a student on Monday to a lecture concerning a given subject, perhaps on Wednesday the student does experiments related to that subject, on Friday a recitation will involve the student in some exposure to the subject and then on Sunday night, late, the student may read on this subject from his text. The audio-tutorial system permits the student to bring all of these learning experiences into an integrated sequence so that each learning event may enhance or complement the adjacent ones and thus result in a synergistic effect. One might compare this analogously to an orchestra. Many musical instruments making sounds in a random fashion, result in noise or cacophony; however, these same sounds, if given timing and placed in an appropriate sequence or relationship one to another form a melody. I am suggesting that there is a melody of learning and that teaching is, indeed, an art. It is the art of sequencing learning events into a meaningful experience for students.

CONCLUSIONS

Education is a science in which one must define the problem first and then go about logically developing a procedure that permits a student to engage in those activities which result in learning. It may require a total restructuring of courses and reorganization of approaches. Teaching is an art, but the artistry comes not through the use of the teacher as a communication device but rather through his skill in determining objectives and in developing the materials and sequences which will enable the students to achieve those objectives in the most efficient and effective manner.

Many of us find this approach to education a little difficult. Teachers and educators are the most tradition-bound group of individuals I know. They got this way in a logical, evolutionary sequence, the explanation of which is relatively simple. In the days of Aristotle, the source of information was the scholar and he was the communication vehicle. Contact between the student and the educator was through lecturing. It is amazing that many of us still teach in this fashion, feeling that our contribution is to expose to the student our knowledge of the subject matter, and many people who want to become teachers do so merely because the lecture is an ego-inflating device. We find it an exhilerating experience to stand before five hundred people and to mystify them with our great knowledge of a subject. But in this age there are many communication devices more effective than the human being, and ego-inflation of scholars is not a worthy objective for an educational system.

We lost sight of the basic purpose of education a long time ago. When there was one teacher and one student, the teacher focused on the individual needs of that particular student, but when the teacher had two students, the focus was changed to the needs of the teacher, and the two students had to assemble at the convenience of the teacher. When the situation expanded to involve so many students that two teachers were necessary, one teacher became senior, and a new group of individuals with individual problems was evolved: the administration. It is logical to select for administration the most aggressive and most skillful individual at problem solving. It is logical also that such an individual would solve the problems which were close at hand. During the years, divergent evolution has occurred to produce a community of individuals who are concerned with problems of constructing buildings, obtaining funds, etc., and learning problems are given lower priority. With our administrators preoccupied with these problems, only lip service is given to such mundane things as the proximity of experiment A to experiment B. Such small, insignificant items are cast aside in favor of the more challenging and interesting activities associated with the vast numbers of students and big-time education.

I would like to cite just one example. A certain university begins its semester with the first classes meeting at 11:30 A.M. on Wednesday. I challenge educators at that institution and at any other institution to show me a course for which good pedagogy dictates 11:30 A.M. on Wednesday as the appropriate time to begin the semester. I know of many courses, multiple-section courses, for which this timing is clearly a disadvantage. Multiple-section courses which meet on Monday, Wednesday, and Friday will have some sections which will have been exposed on Wednesday afternoon and Friday afternoon, and other sections which will have been exposed only on Friday, so that the subsequent week's work will be totally out of synchrony. As a result, instructors and students alike recognize the impossibility and impracticability of this situation, so that students do not show up on Wednesday afternoon—and if they did, they would find a sign on the door saying, "No class today." For all practical purposes, it is impossible to start course work until Monday morning of the subsequent week.

Now I ask you, if good pedagogy does not dictate that classes begin at 11:30 on Wednesday, what criterion *is* used to establish the starting time? The answer is simply that this starting time is an administrative convenience and that administrative convenience is taking precedence over sound pedagogical procedure. This is merely one example, and if time permitted, I could cite you many more.

One more thought. It was suggested to me that if one wishes to attract outstanding faculty to a university today, it is necessary to provide ideal teaching conditions. I should like to analyze this statement for you. What is meant by outstanding faculty? Outstanding faculty on most campuses are Nobel prize winners or those who have demonstrated competence in research activities. And what is meant by ideal teaching conditions? The answer is, few hours in the classroom and highly selected students who will learn in spite of the instructor. We have come to the point where instructors consider it a promotion when they are given the best students in the university or high school. I am suggesting to you that this is not a professional attitude. What would you think of a doctor who wished to take only those cases which he could cure by merely dispensing aspirin? Most of us would say that this wish is unprofessional, and we would not want a doctor of this kind. We want a doctor who would like to concern himself with the hard-to-get-well cases, those cases which are challenging. If this be true, and if teaching is a profession, a professional attitude would demand that we too would find the hard-to-get-well cases most challenging. Humbling as it may be, self-examination may be in order for us to determine whether we really fulfill our role in the educational process. Are we succumbing to the ego-inflating exercises which display our great knowledge of the subject matter, or are we willing to accept our responsibility to provide the facilities, provide the guidance and direction, and provide the motivation to help students learn? Let us be honest with ourselves and true to our commitment.

JOHN E. TIRRELL

SOME REFLECTIONS ON 150 MAN-YEARS USING THE SYSTEMS APPROACH IN AN OPEN-DOOR COLLEGE

You have already heard from our "patron saint" Samuel Postlethwait of Purdue University. We feel deeply indebted to Dr. Postlethwait for his insight, courage, and pioneering spirit, a landmark in the revolution of instruction in higher education. Today, as one of his admirers, I should like to report on the adoption of his approach, using systems, in an open-door community college. Since we have more than 150 professionals engaged in our efforts, the title of this paper appears justified.

It is most appropriate that we make this report about our efforts at Oakland Community College at this conference on the UCLA campus, since B. Lamar Johnson is the person most responsible for our having the courage to undertake such a massive experiment in higher education. The North Central Association of Colleges and Secondary Schools assigned Dr. Johnson as our consultant, even though he has resided outside our area for many years. I assume that this was done because we had proposed making extensive exploratory studies before coming to a decision affecting the nature of our curriculum and instructional program, and because he is recognized as one of the most knowledgeable—if not the most knowledgeable—person in the country in this field. During his visit in January 1965, we were weighing the possibility of being partially or entirely innovative in our instructional program. In his thoughtful, friendly, but persuasive way, Lamar discussed with us the need for more "islands of innovations" in the community college movement.

If we have any success, Sam Postlethwait and Lamar Johnson can take the credit for giving us the model and courage!

SYSTEMS—AND A NEED FOR CHANGE

Many of you see the perceptive writing of Ralph McGill. Every few weeks he writes knowingly about some educational development. As a commentator on the contemporary American social scene, he apparently considers education a crucial aspect of the social matrix. In a recent column, headed "Need for Hurry—Out with Old Schools," he said:

> A flat statement that the United States public school system is obsolete and should be abolished because it cannot any longer do the job for which it was created is, for most persons, a verbal slap in the face.

> Yet, work already has begun on doing just that—abolishing the old system.
>
> The statement is essentially true. The public school system is not able to do the job for which it was created. It hasn't been doing the job for a good many years. There is massive evidence, much of it visible to the naked eye, to sustain the charge.

Since we in the community-junior college movement are attempting to disassociate ourselves from the K-12 public system, and might merely shrug this observation off as not applicable to our concern, let us listen to another thoughtful observer of American society. John W. Gardner, in his *Self-Renewal,* opens the third chapter, on "Versatility," as follows:

> ...If we indoctrinate the young person in an elaborate set of fixed beliefs, we are insuring his early obsolescence. The alternative is to develop skills, attitudes, habits of mind and the kinds of knowledge and understanding that will be the instruments of continuous change and growth on the part of the young person. Then we will have fashioned *a system that provides for its own renewal.*
>
> This suggests a standard in terms of which we may judge the effectiveness of all education, and so judged, much education today is monumentally ineffective. All too often we are giving our young people cut flowers when we should be teaching them to grow their own plants. We are stuffing their heads with the products of earlier innovation rather than teaching them to innovate.[1]

I often quote the work on creativity done by Calvin W. Taylor and his associates. In the summary statement, "A Look Ahead," Taylor states:

> An implicit criticism of conventional methods of education has been gaining ground. It is quite apparent at this writing that the educational methods now being discussed under such rubrics as "programmed instruction" will soon be the most important force in determining curriculum sequence and perhaps even content, and moreover, will be important in fostering our quality of thought, paradoxical though this may seem. Like many paradoxes, this one arises from limitations or misdirections of language; the point is that such instructional programs permit this individual to go at his own pace, which may be much faster than one would imagine, and to participate actively in the learning process rather than being the passive target of a teacher.[2]

There have been numerous studies and reports by educational groups calling for change and outlining some of the very obvious resolutions needed. The American Council on Education's Commission on the College Student in a report, *They Come for the Best of Reasons,* concluded:

> There is need for every college to reaffirm the individual nature of the educational process as it is experienced by each student...The burden of the data reviewed here suggests that many, if not most, colleges should review their first-year programs with the primary purpose of providing opportunity and encouragement for independent study, so that students may make the maximum use of their abilities and develop skills which will enable them to pursue their educational careers with optimum effectiveness and satisfaction.[3]

The National Commission on Technology, Automation and Economic Progress points out, in its publication *Technology and the American Economy,* the desirability of the system approach:

> The [system] approach has two main features. First, objectives are stated clearly in

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[1] (New York, Evanston, and London: Harper & Row, 1963–1964), p. 21.

[2] *Creativity* (New York: McGraw-Hill, 1964), p. 388.

[3] (Washington, D.C.: The American Council on Education, 1958), pp. 43–44.

> performance terms rather than in particular technologies or pre-existing models... The advantage of specifying objectives in system terms is that it forces decision makers to so delineate the factors that a rational comparison of alternative solutions is possible.
>
> The second feature of the system approach is its emphasis upon the interrelations within a system. The usual approach has been to divide a problem into more manageable subproblems... Since any one problem is so directly linked with others, it has to be viewed in its entirety. In short, what a system approach implies is comprehensive planning so that we can trace out the effects, progressive and regressive, of any set of choices and decisions upon all other relevant decisions.[4]

In March 1962, a two-week meeting sponsored by the United Nations at the UNESCO house in Paris, France, was attended by educational representatives from a majority of the countries of the world. The subject of the meeting was "New Methods and Techniques in Education." One of the major conclusions of the expert group concerned the implications of these new media and methods for educational systems:

> A. Particular attention is recommended to the development and use of imaginative ways of combining, for maximum educational gain at minimum cost, the resources of mass-media, of self-instructional programming methods, and of teacher-teams....
>
> B.... Special emphasis should be placed on adapting to all media, the techniques of feedback from individual students.... Such feedback to the producer should consider factors of acceptance and attitude as well as instructional efficiency.
>
> C. Research of a fundamental nature is needed to improve basic understanding of the learning process....
>
> D. Special emphasis should be placed on developing the potential of individual programmed instruction methods....
>
> E. An intensive effort should be devoted to obtaining and collecting data on comparative monetary costs and expenditures required for alternative means that seem to be capable of attaining a particular kind of needed educational outcome. Factors taken into consideration in collecting such data should, however, not only be the monetary outlay, but also the effect on manpower, on the required time, and on the improvement of quality of instruction.[5]

This is the background which provided us at Oakland with the motivation to develop a college-wide systems approach to teaching and learning. Interest in what we have done may in large part emerge from the fact that we are the first institution to use a systems approach throughout its curriculum. In a proposal written for our Board of Trustees, Litton Industries concluded:

> It is clearly indicated that the Oakland Community College system approach represents the first full-scale operational model of higher learning which totally reflects the recognized needs by international educational and training authorities.

DEVELOPING A SYSTEM

Before we designed our instructional program, we made a review of literature—supplemented in some cases by interviews and observational visits—in three areas:

1) principles of learning;

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[4] (Washington, D.C.: National Commission on Technology, Automation and Economic Progress, February 1966), p. 99.

[5] *New Methods and Techniques in Education,* UNESCO/ED/190 (Paris: United Nations Educational, Scientific and Cultural Organization, 1962), multilithed, p. 8.

2) class size and space and time utilization;
3) innovations in teaching—including, for example, some of the work at Florida Atlantic University, System Development Corporation's computer-based classroom, and, of course, Professor Postlethwait's work at Purdue.

As a result of this investigation and review, we concluded that there are three major factors in learning which must be recognized in any plan that we might develop:

1) motivation is primary;
2) the active learner learns most—and in a shorter time;
3) feedback is necessary to accelerate and raise the quality of learning.

On the basis of these findings, we developed a plan which is a learner-centered, systems approach to instruction and which features a learning laboratory and feedback. In describing and discussing what we are doing at Oakland, in a recent issue of the *Junior College Journal,* I wrote in part:

> Individual study of learning sequences developed by the instructional-systems approach in a tutorial laboratory using multimedia employed at O.C.C. presents a striking contrast to the methods and techniques of conventional instruction. Conventional methods of teaching are basically teacher-oriented or "open-loop" instructional systems. The teacher plans and organizes his subject matter presentation in terms of coverage of material in specified units of time; he tells groups of students what he considers to be relevant based on his best estimate of what is important and what degree of understanding he wishes to achieve in his students. Little provision is made for directed and continued student response and correct answer confirmation as the prime criterion for the design and pacing of instruction.
>
> The student usually plays a passive role, being neither required nor able to respond and receive correct answer confirmation in the learning process.
>
> There is usually no finite prestatement of final or terminal performance objectives specifying exactly what the individual student must be able "to know" and "to do" to achieve acceptably.
>
> With conventional "open-loop" instructional models, the student is evaluated by means of tests which sample the material covered during the instructional sequences. The test questions may or may not be relevant to points of significance required for the concise understanding of principle, concept, or application involved.
>
> The instructional systems approach applied at O.C.C. is a learner-centered or a "closed-loop" model of instruction. It is a self-adjustive performance system based specifically on the predefinition of (1) what is to be learned, (2) the required levels of terminal or final proficiency to be achieved by learners, and (3) the most appropriate sequence of instruction for learners to insure their success on each progressive step leading to the attainment of the prestated terminal performance specifications stated in behavioral terms.
>
> Of critical importance in designing the "closed-loop" instructional model as applied in the tutorial-laboratory situation is the prespecification of the "critical or optimal learning path." This learning path is limited to "need to know" instructional requirements; the use of relevant demonstrations only, exercises, etc.; the reinforcement of concepts to be learned; the sequence and order of presentation of instructional components to be included as integral parts of the instructional sequences; the prescribed role of instructor and student in each instructional setting; and, of great significance, the means for controlling pacing of learning based on the measured understanding of individual students.
>
> In contrast to conventional methods of curriculum planning and instruction in institutions of higher learning, the Oakland Community College-designed and -im-

plemented instructional methods are primarily student- or learner-oriented. Courses of instruction have minimized traditional group teaching applications. Instead, students are provided carefully designed instructional sequences which stress supervised self-directed instruction. Learning is controlled and paced by the individual student, consistent with his abilities to perform successfully.

The model of self-directed learning at Oakland Community College is based on the work of Professor Samuel Postlethwait of Purdue University. With the audio-tutorial or tutorial-laboratory model of instruction developed by Dr. Postlethwait, the responsibility for learner achievement rests primarily with the learner himself. Instructional materials, equipment, and all other resources required for successful terminal achievement are provided each student in a specifically designed study carrel. Self-directed instructional sequences include use of multimedia such as audiotapes, visual displays, books, periodicals, laboratory experimental set-ups, programmed materials and manuals. Faculty members are always available as tutors during self-directed study activities to assist students, when requested, in achieving predefined knowledge and skill objectives.

This "tutorial laboratory" environment enables the student and instructor alike to utilize their respective abilities at maximum capacity. In essence, the method places the responsibility for learning and the mechanics for study time on the student while permitting the instructor to have maximum personal contact with the student on a "need to know" basis. The instructor, then, can more efficiently direct his skills toward orientation and guidance.

Students are provided large group assemblies on a scheduled basis, mainly for motivation. A skilled "master teacher" uses this time to discuss course objectives, present new developments in the field, point out applications of the subject matter, and integrate subject matter with other areas in the predesigned educational program. Student performance is frequently evaluated by written, performance, and/or oral exams used as the basis for advancement and to furnish feedback information to the learner.[6]

Preparing for the opening of college in September 1965 posed a real challenge. We were to use a systems approach to instruction, and plans for teaching and materials of instruction had to be ready for use. In addition, the faculty had to be prepared to use a systems approach to teaching. With this in mind, we employed eighty faculty members for two months in the summer of 1965. They studied systems-design applications, their own roles and functions, evaluation criteria and techniques, and teaching strategies. In addition, they actually prepared the materials of instruction to be used in their courses.

OUR STUDENTS AND THEIR REACTIONS

Now that we have had a year's experience at Oakland, it is useful for us to look at our students and, in particular, at their opinions regarding the program.

Oakland Community College opened in September 1965 with an enrollment of more than four thousand—the largest student body at the opening of any junior college. Only 6 per cent of our students had been in the top fifth of their high school graduating classes, while 41 per cent had been in the lower 30 per cent. On the College Qualification Tests, using national freshman norms, we had a more normal distribution of students than would have been expected on the basis of high school class rankings. Approximately

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[6] "(Total!!) Independent Study at Oakland," *Junior College Journal,* XXXVI, No. 7 (April 1966), 21–22.

25 per cent were in the top one-fifth of national norms and only 9 per cent in the bottom one-fifth.

Three-fifths of our students were eighteen or nineteen years of age, and males outnumbered females five to two. Nineteen per cent were married and one-third had attended another college before coming to Oakland. Forty-seven per cent of the students enrolled in transfer programs, 30 per cent in the General Studies Program, and 23 per cent in vocational-technical fields. Eighty-four per cent of the students carried twelve credit hours or more, and were, therefore, classified as full-time students.

During the spring of 1966, we asked a randomly selected group of 438 students their reactions to varied features of our program. Overwhelming numbers of the students agreed that instructors were available in the learning laboratories, that they were willing and well qualified to provide assistance, and that they answered student questions clearly and succinctly. Three-fifths of the students agreed that there was sufficient opportunity to get acquainted with students, and three-fourths felt that there was sufficient opportunity to get acquainted with instructors. On the other hand, only 10 per cent thought there was a "good feeling of school spirit." Although school spirit is a problem at many commuting colleges, this is a matter to which we shall give attention.

Students overwhelmingly favored our present plan of free attendance at learning labs—as opposed to scheduled periods of attendance. Opinion was evenly divided regarding the requirement of attendance at general-assembly sessions of courses. In general, students who had attended other colleges thought that their work at Oakland was equally difficult with that at the colleges they had previously attended.

Since the "Accousti-Carrel" used at Oakland has been patented by the college, we were interested in knowing whether students liked it. Less than 30 per cent of the students reported disliking the carrel.

In addition to seeking the judgment of the randomly selected group of students to which I have just referred, we questioned both honor students and probation students and found that 69 per cent of the probation students were employed outside of college as compared with 56 per cent of the honor students. Forty-three per cent of the honor students and 18 per cent of the probation group had attended college before coming to Oakland.

As might have been expected, honor students study more than those who are on probation. The largest number of honor students (39 per cent) spent 21–35 hours a week in the carrels while the largest number (41 per cent) of probation students spent 1–14 hours a week. Although 14 per cent of the honor students spent more than thirty-five hours a week in the carrels, no probation student reported spending this much time.

Instructional materials were judged "favorable" by 62 per cent of the honor group and by 42 per cent of the probation students. Materials were rated "poor" by 2 per cent and 12 per cent of the honor and probation students, respectively. "Poor study habits" was reported to be the biggest problem of probation students. No honor student, however, reported this is a problem.

In response to an open-end question, "I wish I could . . . ," probation students made such responses as:

Study more. I would really like to learn.

Quit school, work a while, then come back to school if I wanted to.
Drop out of college.

These were among the answers from honor students:

Return as a faculty member some day.
Avoid the draft, travel forever, learn everything, but forget most of it.
Tear out all the carrels and replace them with small, isolated cubicles.
Take this system to Michigan State University with me this fall.

Evaluation must be and is a continuing part of operations at Oakland. Student judgment—along with follow-up studies and surveys of achievement—will consistently be sought as one means of appraising what we are doing.

SOME SUGGESTIONS

On the basis of our experiences at Oakland—brief though they have been—I have a few suggestions for any college which may be considering the use of a systems approach.

1. It is essential that the board of trustees be committed to the use of systems—whether on a limited or college-wide scale.

2. The administrative leadership of the college must understand and be committed to the systems approach.

3. At least in initial stages of development, a small group must exercise tight controls over the system to avoid "bending" the system.

4. A workshop—several weeks in duration—during which participating faculty members devote full time to study and planning is essential. Three weeks is, in my judgment, a minimum length for such a workshop. I strongly prefer the two-month period which we used for any sizable operation.

5. Careful coordination of staff efforts are essential, at least during the first year. This involves considerable in-service training.

6. Careful control (including approval) of terminal performance specifications, interim performance specifications, learning situations, and media selection by one person or by a small group is important.

It will be noted that I have emphasized control and coordination. This emphasis is clearly needed—at least in the initial stages of operation—if the fundamental integrity of the systems approach is to be preserved. During the initial period of "heavy control," a struggle is likely to occur between those who see a need for centralized authority and decisions and those who feel a need for autonomy—between particular units of the college as well as between staff members individually. The goal must be to achieve coordinated control and, concurrently, to encourage individual creativity.

If we are committed to the systems approach, if we have centralized approval of terminal-performance specifications, if we consistently use feedback, if we use varied means of evaluation, we can and must bring about an evolution of the organization and administration of the operation. Within such a framework there is clearly a need for both coordination and creative initiative.

CONCLUSION

The innovator finds plenty of critics in his departure from conventional practice. If they are in the field of education, they might be asked what evidence and data they have to support what they are doing. Only the innovator, it seems, is called on to evaluate what he does; others can rely on "tradition and custom." We propose—as I have suggested earlier—continually to assemble evaluative evidence regarding our program. This is, of course, essential to the systems approach.

After 150 man-years of experience, we can assert that using the systems approach is actually not much more difficult than merely talking and writing reports about change. The need for change in education is abundantly clear. Remember McGill's "massive evidence of obsolescence" and Gardner's observation that "much education today is monumentally ineffective."

We at Oakland are committed to change—not simply for the sake of change, but as the basis for improving a system which is, I fear, absolescent and monumentally ineffective.

MERLE H. SMITH

THE DEVELOPMENTAL PROGRAM WITHIN THE SYSTEMS APPROACH TO INSTRUCTION

It was in July 1965 that the Oakland Community College staff began preparations for a revolutionary approach to education. We were not experts, but we shared one common idea: perhaps there was a better approach to learning than the traditional methods which we had experienced.

The planning stages were exciting. Here was an opportunity to throw out traditional techniques that had troubled us. The magic "three lectures per week" would be the first to go. No more "togetherness," expecting all students to progress at the same rate. No more rigid scheduling of courses, with instructors too frequently unavailable to assist students.

All departments experienced problems, but I feel that we in English had the greatest difficulty in adapting to the systems approach. In fact, when the Professional Standards Committee elected me to represent the Oakland faculty at this conference, I expressed my concern because I am from the English department—the department which apparently has had the most difficulty in using the systems approach. Why not, I asked, send someone from the mathematics or science departments, where there had been great successes with the systems approach? But, I was told in response, educators would be interested in our trials, errors, and successes in English for two reasons: first, because all students are required to take English, and, second, because many colleges have a remedial or a developmental course in English and will be interested in the special problems associated with applying the systems approach to such courses. Accordingly, I was convinced that you would be interested in what I have to report.

DEVELOPMENTAL ENGLISH

Since my experiences at O.C.C. have been restricted to two areas, I will confine may remarks to developmental English and the preparatory program. You may recognize developmental English by a number of other names—basic, remedial, preparatory—but I am referring to that course which supposedly prepares the student for his first experiences with college-level English.

The first logical step was to establish the terminal performance specifications. There certainly was nothing unique about what we expected the student to accomplish. He should be able to read at a minimum of 280 words per minute with a comprehension rate of at least 80 per cent. He should be able to write a coherent, unified, concise paragraph. He should be able to state the main idea of a short essay or chapter of a book in not more than fifty words. We would give him all the tools available: reading, machines, filmstrips, handouts. And surely we could expect achievement which would far surpass anything we had experienced in the traditional system.

At about this stage of planning we were visited by Samuel Postlethwait. He kindled our enthusiasm and generated confidence by expressing his philosophies and techniques of teaching. We set about using Dr. Postlethwait's methods. The learning steps would be short, easy to master, and there would be special tracks for students having difficulties. We would place little emphasis on the General Assembly Session (christened GAS by Dr. Postlethwait), and we would not require attendance. In fact, we would schedule such sessions for all students only as they were needed for the clarification of plans and problems. Small assembly sessions (that is, in class sections) would be used primarily for testing.

PROBLEMS ENCOUNTERED

So many things went wrong that first semester that I could not possibly list them all. At the close of the semester, we looked at the achievement of our students and we were embarrassed. Where had we failed? Although we knew that most of our freshman students in developmental English would be less motivated for learning than sophomores at Purdue University, we did not realize how important this factor would be in using the systems approach without adequate orientation. Sixty per cent of the students failed to complete the course satisfactorily—about the same percentage which I had experienced for six years in a college using a traditional system. We discovered that the one common characteristic among this 60 per cent was inconsistent attendance in the laboratory. In fact, half of these students ceased coming to the laboratory at all after the first four weeks. Accordingly, we knew some changes were in order. To get at the cause of the problem we went to the students. They were eager to volunteer their criticisms. There were three major ones:

1. They could not adjust to the freedom to schedule their own time. Since there was no required attendance, they simply chose not to come.
2. They could not adjust to setting their own pace. When they found themselves getting behind, they simply gave up—or they felt they would take an incomplete and try again the next session.
3. They could not adjust to receiving help from a variety of tutors. They felt that no one cared (self-image). They were accustomed to a home base and felt insecure without one.

We thus learned that we had, for the most part, an undisciplined, disorganized student. Oakland had enrolled more than four thousand students in September 1965. Unfortunately, many of the original four thousand did not experience success in all of the courses they attempted. The failure rate was high in all academic areas but embarrassingly high in developmental English. We were not certain what percentage of these failures could be attributed to the "open-door" philosophy. High school records revealed that two-thirds (more than 2,800) of the students who enrolled for the 1965 fall session graduated from the lower half of their class. We concluded that these students were experiencing the same difficulties at O.C.C. that they might have experienced at a traditional community college. This was not meeting our expectations. When we considered the "special philosophy of the community college, the need for educated people in society, the desire everywhere to encourage rather than discourage students"—and, particularly our unique learner-centered instructional-systems approach—the results of our first semester were disappointing.

But we still felt compelled to ask whether the fault lay in the system or in the type of student in the developmental English course. We could do one of two things. First, we could keep the course as it was and assume the attitude of many colleges—that English is a screening course and that 60 to 70 per cent of the students will fail regardless of the methods used; or, second, we could revise the course and the program in hopes of improving achievement. We chose the latter.

To pursue the causes of the learning difficulties just mentioned, a questionnaire study was made in April 1966 of all honor and probationary students enrolled at Oakland Community College. These students were questioned to determine possible reasons for low achievement, particularly in developmental English. The findings of this survey and the experiences of the staff made it evident that a special program is needed for probationary students if Oakland Community College is to meet its commitment to these students.

Direct experience with the learner-centered instructional-systems approach at Oakland Community College indicates that some students are not ready to accept and participate in such an approach. Although during a three-day student-orientation period an attempt was made to explain the philosophy of the college, the lack of readiness to accept our approach to teaching and learning was especially evident among those who had had low achievement in high school. It became evident that those students who had difficulty with the traditional instructional approach in high school similarly experienced problems with the learner-centered instructional-systems approach at Oakland. Other reasons for the low achievement of these students include (1) ineffective communication skills, (2) a limited background of knowledge, (3) low self-esteem, (4) unrealistic vocational goals, and (5) physiological and psychological impediments. We can deal with the first two possible causes through the careful development of courses in such fields as English, reading, mathematics, social science, life science, and physical science. The next two possible explanations, low self-esteem and unrealistic vocational goals, require special attention. In particlar, we must provide learning opportunities which make it possible to improve the self-esteem of low achievers. Physiological and psychological problems may require specialized treatment.

"PREP"

It was with this background in mind that the Dean of Instruction appointed a committee to organize a plan of action to tackle the problem of the low-achieving student. After considerable study, the committee presented the Preliminary Review and Evaluation Program, abbreviated as PREP. A somewhat detailed description of project PREP must be presented so that you can see its relationship to the developmental program within the systems approach to instruction.

It is reasonable to assume that an increasing number of high school graduates with low achievement will be enrolled at Oakland Community College. It is also reasonable to assume that many will experience failure unless special orientation is provided to the systems approach to instruction. The objective of PREP is to increase the probability of academic success for the students admitted to the developmental program.

The Preliminary Review and Evaluation Program is specifically designed to orient probationary students at Oakland Community College to the learner-centered instructional-systems approach and to provide each student with sufficient knowledge about himself, society in general, and occupations in particular, so that he may select a reasonable vocational goal.

All students in the PREP program are required to take one of the two developmental communications courses. Those planning to enter a transfer program are counseled into Basic English, which is the preparatory English class common to most community colleges. Our first experience with students in developmental English, however, revealed a need for a second communications course. The vocational and technological students showed the same lack of English fundamentals that they had demonstrated in high school. Accordingly, we decided to separate them from the transfer students and concentrate on learning specifications which emphasized oral communication. We, therefore, offer two separate courses in communication. Assignments in one course are taken from the business and industrial occupations. Students interested in a four-year degree program are counseled into the other developmental communication course in preparation for the typical first course in college composition.

All students in the PREP program will be required to take a course called Guided Orientation. This course is being planned by a sociologist, and draws heavily on the sociological and social-psychological literature. Course objectives call for the careful establishment of a primary-group relationship (each group will have a maximum membership of fifteen students and one instructor) based on the common concerns of the students, namely, probationary status and how the learner-centered instructional-systems approach operates. The students will have similar backgrounds of low academic achievement, will often view themselves as having less than average academic ability (and many times as failures), and they will often have unrealistic vocational objectives. Once closer social relationships (relationships that are found in primary groups) are established, it is anticipated that the students will freely exchange experiences, ideas, and opinions. The instructor will encourage free exchanges based on personal experiences and feelings, and he will simultaneously provide more objective data, analytical models, and theories that can assist the students in understanding themselves, the significance of vocational choices, and their society. Before completing the Guided Orientation course, each student is required to reexamine carefully his vocational goal in the light of what he has learned. It is anticipated that some students will decide to change their vocational objectives and that many will adhere less rigidly to their initial choices. The course objectives also specify that each student will be able to identify the underlying assumptions and explain the learner-centered instructional-systems approach.

Students enrolled in PREP select one of three developmental mathematics courses on the basis of a placement examination. It is also possible to enroll in a more rigorous course if the test results are sufficiently high. Students enrolled in PREP may elect one additional course from a limited list of courses which demand little communications skill. Examples are art, automotive mechanics, food service, and drafting courses. No student enrolled in PREP can take more than four courses, and all students enrolled in PREP must take the Guided Orientation course and one of the developmental communications courses.

Students in PREP are divided into small classes and bloc-scheduled into Guided Orientation and a communications course, i.e., the same students attend both Guided Orientation and communications together. This is another attempt to encourage a primary-group relationship among the students. It also provides a basis for close cooperation among instructors responsible for the same students. Instructors plan together and integrate their assignments as much as possible to expand, clarify and reinforce the objectives of PREP. This scheduling technique focuses attention on the students. This is the essence of PREP.

It is our hope that the PREP program will reduce the number of problems the probationary student encountered during the past two sessions with the systems approach to instruction. Hopefully, he will learn to handle the freedom of making his own schedule and disciplining himself within his schedule. Hopefully, he will select a realistic vocational goal and, consequently, be more highly motivated.

CONCLUSION

Let me repeat that I am convinced that the probationary student has no more problems under the systems approach than he does under more conventional plans of instruction. This belief results from six years of teaching comparable students under traditional methods at another college—with almost identical percentages of failures in the two colleges.

At present, I am fortunate to be at a college which asserts that a 30 to 40 per cent salvage rate is unsatisfactory. Oakland Community College has accepted the challenge of looking for solutions to the high failure rate. It recognizes the fact that unless low-achieving students can be placed in a satisfactory program, they very likely will return to society as frustrated citizens. Accordingly, we do not want to use English simply as a screening device.

After almost one year's experience with the systems approach to instruction, we are optimistic that it can be employed successfully within developmental courses. We recognize, however, that the low achiever must be thoroughly oriented to such an approach before he can successfully make the transition from years of experience with the traditional methods. It is our hope that project PREP will provide this transition.

SECTION III

Evaluation

B. LAMAR JOHNSON

RETROSPECT AND PROSPECT: A CONFERENCE CRITIQUE

Education is America's growth industry. We can envision the day of peace—and soon, I hope—when our nation diverts to education vast sums now being spent for armaments and war. In addition to new and important technological aids to teaching and learning, we can anticipate a major expansion of funds for our schools and colleges. What a prospect!

In a sense, the attendance at this conference confirms the fact that education is America's growth industry. Represented here today, among others, are Litton Industries Science Research Associates (a subsidiary of International Business Machines Corporation), and University Microfilms (a subsidiary of Xerox Corporation). The participation of such giant industries as these suggests the magnitude of education—not only today, but particularly in the day of peace which is to come.

This conference was launched—and its setting was defined—by two keynote addresses which, on the one hand, epitomized the magnitude and the urgency of the task before us in the open-door college; and which, on the other hand, held before us a view of some of the tremendous resources which are, or soon can be, at our disposal. The entire conference has, for all of us, been both a sobering and an exhilarating experience.

John Lombardi held before us the dream of universal higher education as essential to our democratic commitment to permit every citizen to be educated to the level of his highest potential. This commitment is the fundamental bulwark of strength in our nation. In the achievement of this ideal, the junior college, as an open-door college located in the home communities of students, must have a role of central and crucial importance. This is a heavy, complex, and difficult responsibility. Huge numbers of students are in the offing for the open-door college, students with widely diversified abilities, interests, and goals—and, I might add, students with widely diversified problems, frustrations, and needs.

This is, indeed, a sobering situation—one which demands drastic change in our day-to-day operations. But change, as Harry Silberman pointed out, is not enough. Innovation is not our goal—rather, improvement must be the end to which we address ourselves with ceaseless and unrelenting vigor. Vast resources and new tools are, however, about to be put at our command. The potential of the computer in instruction, in administration, and in counseling was, for example, suggested by Harry Silberman. Again on a sobering note, however, he identified and discussed problems in the use of computers in education.

THEORY AND PRACTICE

The emphasis at this conference has been on practice, not on theory. This is not to suggest, however, that theory has been neglected.

Stress has been given to the fact that definition of objectives is the first step in any instructional system—and indeed, in any instructional activity. We have been told that those who design instructional systems would do well to pay less attention to learning theories—and perhaps, also, to educational hardware—and more attention to where they are going. The word *objectives* might appear to have—and does have—theoretical connotations. As used at this conference, however, the word has had a practical ring. Arthur Cohen was not speaking in abstractions when he described the process of defining objectives, a process which can be recommended to any teacher, regardless of whether or not he is committed to a systems approach to instruction. The necessity of defining outcomes has been stated at every session of this conference.

But defining purposes is only a beginning. We must also provide experiences designed for students which will lead to the achievement of objectives. Accordingly, learning experiences and materials of instruction have been highlighted at this conference. Robert Corrigan has reported on the process of developing and validating instructional materials and has described and put in our hands materials that have been prepared at Oakland Community College. Samuel Postlethwait has graphically described the learning experiences of students in his audio-tutorial approach to teaching botany at Purdue University. John Tirrell and Merle Smith have reported both the process and some of the outcomes of instructional planning at Oakland Community College. We have seen the carrel—together with tape recorder and projection equipment—designed and constructed at Mt. San Jacinto College for four courses which will be using the audio-tutorial method at that college.

The reports and discussions of the past three days clearly delineate four trends in systems approaches to instruction:

1. Learning experiences must emerge directly from the purposes of teaching.
2. Varied types of learning experiences can be used—lectures, field trips, discussions, forums, library and textbook assignments, as well as instruction which involves the use of projections, recordings, computers, and other audio-visual aids to learning. This conference has affirmed and demonstrated that a systems approach to instruction is not synonymous with mechanized teaching. The essential is that the learning experience—of whatever type—must emerge from the purposes of instruction.
3. Feedback is necessary. The student must know his achievement, his progress based again on the purposes of instruction.
4. The necessity for recognizing teaching as a continually developing and changing process is built into the systems plans which have been reported here. The necessity of continually evaluating learning—and, therefore, teaching—on the basis of the achievement of objectives requires changes in teaching based on such appraisal. And, I might add, the modification and refinement of objectives are not unknown.

These essentials—theoretically sound and eminently practical—have been explained and clarified during the past three days.

SOME CONCERNS

As I have attended this conference and visited with participants between sessions, I have noted at least seven concerns about the systems approach to curriculum and instruction.

1. There is a concern lest the systems approach result in attention to trivial objectives which can be measured—to the neglect of significant objectives which may not be subject to immediate appraisal. A corollary concern is that instruction may fail to excite students, stimulate them to further learning. Clearly, these are dangers against which anyone using the systems approach must guard. There is, however, nothing in this approach which requires, or even suggests, the acceptance of trivial outcomes. The systems approach simply requires that purposes be clearly stated and defined.

2. There is a concern lest the systems approach mechanize and dehumanize instruction. This, too, must be avoided. Nothing in the systems approach, however, restricts a college to a mechanistic, hardware approach to instruction. Imaginative ingenuity is the only limitation on materials of teaching and types of teaching experiences—limited, however, to materials and experiences addressed to the specific objectives accepted for each particular segment of instruction. Anyone who believes that dehumanized instruction is essential to the audio-tutorial plan simply does not know Samuel Postlethwait.

3. Concern has been expressed lest systems approaches to instruction lead to packaging instructional materials which are "teacher proof." Such an eventuality would inevitably lead to a stereotype of apathy in teaching. Packages, tools of instruction, are not ends in themselves; they are simply means to ends. As they are used, provision must—as has been suggested earlier—ordinarily be made for varied types of learning experiences, all, of course, relevant to the purposes for which instruction is offered. Under such situations, instructors have a centrally important role in defining purposes, in planning and providing learning experiences, in evaluating student achievement, and in revising materials and procedures of teaching. Here, indeed, is an opportunity for creative teaching at its finest. No "teacher-proof" package here.

4. There is a concern because the systems approach, as reported at this conference, fails to individualize instruction. Plans here reported, it is suggested, provide for teaching the same materials to all students—but at a different rate. The degree to which the rate of learning varies is also open to question. It appears to me that the plans discussed at this conference take some faltering steps toward individualization. Much more remains to be done, both on differentiating the materials of teaching and on the rate of learning.

5. Concern has been expressed lest we change the gadgets and the processes of teaching—tinkering with method—but leave the curriculum untouched. This could happen. At this conference, relatively little has been said directly about curriculum. Nevertheless, the systems approach provides a framework within which curriculum revision can take place. Continually, stress is given to the central importance of objectives. This is fundamentally the essential basis for curriculum construction, curriculum improvement.

6. Concerns have been expressed about the role of industry in education and, particularly, in systems approaches to education. At this conference, we

have, in fact, been told that if present trends continue, the future of education may eventually be in the hands of a "handful" of corporation vice-presidents. Clearly, the abdication by the teaching profession of responsibility for the purposes of teaching, the procedures of teaching, and the materials of teaching would be a sad day for American education. Fundamental controls are and must remain the responsibility of our faculties. On the other hand, the involvement of industry in education has potential for notable value—as we expand and strengthen the resources for teaching which are available to us.

7. A concern has been expressed about who will produce the instructional materials needed in systems approaches to instruction. We have been told that teachers cannot do it; they do not have the time, and often do not have the talent. We are told that university professors cannot do it; they are enmeshed in a publish-or-perish complex in which the production of instructional materials is given little credit for advancement on the ladder of promotion. We have further been told that industry cannot produce the materials; stockholders are too eager for dividends to permit necessary long-term analysis, repeated field testing, and revision. It has been suggested that the regional laboratories being established by the United States Office of Education may be the best vehicle for preparing the necessary materials. Actually, it would seem clear that no single agency can produce the materials that we need. All of the agencies which have been mentioned—and others—must be involved in producing the varied materials we must have.

TWO HOPES

Several years ago, an instructor in a junior college represented at this conference wrote a letter to the president of his college in which he asserted:

> Every instructor has heard again and again that successful teaching depends upon motivating his students. This statement has become a pedagogical cliche, but no instructor is likely to deny its truth . . .
>
> . . . a teacher is working at his art week in and week out . . . Nobody says anything to him (about his work) because it is assumed that he is doing his job—and he is. The same percentage of students continue to pass his courses. His reputation among students remains about the same. His hair turns grey or disappears, a few more wrinkles appear each year, and annually his bifocals become stronger. Everyone is satisfied. He is a successful teacher and is considered to be a credit to his college. But he knows whenever he thinks about it that he is bored, bored stiff . . .
>
> . . . Teachers are expected to motivate their students, but who in the wide world or what in the same world is expected to motivate the teachers . . . here is an area of activity that has been shamefully neglected.

The problem of this instructor is by no means unique in American education. Multitudes of faculty members in the schools and colleges of our nation are "bored, bored stiff," as they, in a pedestrian fashion, repetitiously go through the motions of teaching "the same old thing in the same old way" year after year. This is a situation which represents both a challenge and an opportunity to every junior college administrator and also to every junior college instructor.

My first hope is that as a result of this conference, some junior college faculty members—either as a result of their own attendance and participation or as a consequence of the attendance of a colleague—may be stimulated to try out new ideas in teaching, ideas which may relieve some of their boredom and which may concurrently lead to increasingly vitalized teaching.

During the planning of this conference, Arthur Cohen formulated the following statement of an anticipated outcome:

> Within one year following the completion of this conference, a significant percentage of the participants will introduce some facet of an instructional system at their own colleges:

a unit of a course	50 per cent
an entire course	12 per cent
an entire department	5 per cent
courses in more than one department	5 per cent
an entire college	2 per cent

You will recognize that the percentages represent Mr. Cohen's estimates of the proportion of those who have been here who may be expected to introduce some facet of systems instruction—in some cases, no more than more specific definition of objectives—in their own situations.

My second hope, then, is that, as a result of this conference, an appreciable number of participants (I should be pleased with the achievement of the "Cohen percentages") will try out some facet of the systems approach to teaching. It is clear, of course, that a realization of this second hope will concomitantly contribute to the achievement of the first, for it will inevitably lead to the relief of boredom in teaching.

During this conference, something has occurred that gives me some optimism regarding these two hopes. Late Tuesday afternoon and throughout the evening—separate from the conference—Arthur Cohen held an "Instructors' Workshop," the announced purpose of which was to identify, in specific and practical terms, steps instructors may take in starting the use of a systems approach in their teaching. It is, I think, significant that despite the heavy schedule we have had these days, fifty-one members of the conference participated in this extra workshop. This attendance indeed gives evidence of the likelihood that some facet of instructional systems will be introduced at colleges here represented.

CONCLUSION

Those who came to this conference hoping to get acquainted with an approach to curriculum and teaching—and, in particular, with a systems approach—have found what they were seeking. They have heard the theory of instructional systems; they have seen the step-by-step development of the systems approach in individual courses and in a total college program; they have observed the process of developing and validating instructional materials; they have seen and, in some cases, used such materials. They have come to know some of the hardware used in several programs; and, in the case of many, they have analyzed the "steps in getting started," as these are related to their own responsibilities for instructional leadership or to their own teaching situations.

Imaginative approaches to teaching have been central to much that has happened here, such as plans that permit the creative use of widely varied teaching resources and widely varied methods of teaching. All these plans, however, occur within a framework which requires the identification of purposes, the planning of learning experiences addressed to those goals, evaluation on the basis of these objectives, and a continuing revision of the processes and materials of instruction, based on evaluation. These characteristics of the conference, plus the obvious interest of those who are here, add to the likelihood that aspects of instructional systems will be introduced in many of the colleges and classrooms here represented.

This conference has clearly pointed out values which instructional systems can have for the open-door college—an institution planned for students with widely diversified abilities, interests, and goals, as well as widely diversified problems, frustrations, and needs.

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Occasional Reports from UCLA Junior College Leadership Program:

1. Frederick C. Kintzer. *Faculty Handbooks in California Public Junior Colleges* (Junior College Leadership Program, Occasional Report No. 1), Los Angeles: University of California, Los Angeles, 1961. Price, $1.00.

2. Frederick C. Kintzer. *Board Policy Manuals in California Public Junior Colleges* (Junior College Leadership Program, Occasional Report No. 2), Los Angeles: University of California, Los Angeles, 1962. Price, $1.00.

3. *Institutional Research in the Junior College—A Report of a Conference* (Junior College Leadership Program, Occasional Report No. 3), Los Angeles: University of California, Los Angeles, 1962. Price, $1.50.

4. Frederick C. Kintzer. *President's Report in American Junior Colleges* (Junior College Leadership Program, Occasional Report No. 4), Los Angeles: University of California, Los Angeles, 1963. Price, $1.50.

5. *Establishing Junior Colleges* (Junior College Leadership Program, Occasional Report No. 5), Los Angeles: University of California, Los Angeles, 1964. Price, $1.50.

6. B. Lamar Johnson. *Islands of Innovation* (Junior College Leadership Program, Occasional Report No. 6), Los Angeles: University of California, Los Angeles, 1964. Price, $1.00.

7. B. Lamar Johnson, ed. *New Directions for Instruction in the Junior College* (Junior College Leadership Program, Occasional Report No. 7), Los Angeles: University of California, Los Angeles, 1965. Price, $2.00.

8. B. Lamar Johnson, ed. *The Junior College Library* (Junior College Leadership Program, Occasional Report No. 8), Los Angeles: University of California, Los Angeles, 1966. Price, $2.00.

9. B. Lamar Johnson, ed. *Systems Approaches to Curriculum and Instruction in the Open-Door College* (Junior College Leadership Program, Occasional Report No. 9), Los Angeles: University of California, Los Angeles, 1967. Price, $2.00.

For Sale by UCLA Students' Store